Children's Informal Reasoning Skills and Epistemological Beliefs within the Family: The Role of Parenting Practices, Parental Epistemological Beliefs and Family Communication Patterns

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Declaration of Originality

I hereby declare that the material in the dissertation entitled "Children's Informal Reasoning Skills and Epistemological Beliefs within the Family: The Role of Parenting Practices, Parental Epistemological Beliefs and Family Communication Patterns" either in terms of this current version or another version has not been previously submitted to any other faculty.

I hereby certify that I am the sole author of this dissertation and in the content of my work, I have used no other sources than those explicitly indicated and where due acknowledgement has been made.

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Grace, Shiao En Chng

Bielefeld, 30.04.2012

Ralph Waldo Emerson

The reward of a thing well done is to have done it.

ABSTRACT

Objectives: The current work formulated theoretical models for empirical testing based on three objectives: 1) to explore the associations of familial variables, specifically with regards to parental socialization, with two cognitive aspects of good thinking in children - their informal reasoning skills and their epistemological beliefs, 2) to test the relation between these two competencies as epistemological beliefs have been found to enhance or constrain reasoning, and 3) to investigate if certain familial factors can significantly mediate the direct effects of socioeconomic status on these outcomes.

Participants: A sample of 1994 participants, 997 fifth-graders and 997 of their respective parents, from the longitudinal project FUnDuS "The role of familial support from parents in discourse and written competence in lower secondary schools" conducted in North-Rhine Westphalia, Germany, was used.

Measures: Questionnaires measuring the a) four Parenting Dimensions of Autonomy-support, Control, Responsiveness and Structure, b) Family Communication Patterns of Conversation- and Conformity-orientations, c) Epistemological beliefs of both parents and children, specifically beliefs in Justification by Authority, Personal Justification, and Simple and Certain Knowledge, and d) Socioeconomic status, were used. There were also two measures of evaluative reasoning competence in an everyday problem context: i) Reasons Evaluation and ii) Argument Differentiation.

Results: The data was analyzed with quantitative statistical methods and path analyses. The results show that amongst the parenting dimensions, only Control emerged as significantly detrimental to children's informal reasoning skills and is associated with lower-level epistemological beliefs of knowledge being simple and certain. Conformity-orientation within the family was also associated with poorer evaluative skills of children. More advanced parental epistemological beliefs, such as weaker

beliefs in Simple and Certain Knowledge and Justification by Authority, were associated with more effective parenting practices of Autonomy-support, Responsiveness and Structure, and with less use of Control. Additionally, parental epistemological beliefs were found to be significant predictors of children's epistemological beliefs. The association between children's epistemological beliefs and reasoning skills was also confirmed: higher-level beliefs were related to more skilled evaluative reasoning. Lastly, familial variables of parental control and conformity-orientation were found to be significant mediators of the direct effects of SES on children's Reasons Evaluation skills and on their Simple and Certain knowledge beliefs.

Conclusion: The results are empirical evidence of first, the associations of parental epistemological beliefs and their parenting practices, and second, the significance that parental epistemological beliefs and parenting practices hold in the fostering of children's reasoning skills and epistemological beliefs. To focus on skills of informal reasoning skills and epistemological beliefs is to focus on enhancing one's ability to think well. The implications of the results, limitations and future research directions are discussed.

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NOMENCLATURE

ANOVA – Analysis of Variance

CASMIN – Comparative Analysis of Social Mobility in Industrial Nations

CFA – Confirmatory Factor Analysis

EFA – Exploratory Factor Analysis

EOC- Epistemic and Ontological Cognition

EOCM – Epistemic and Ontological Cognition Model

EOCQ – Epistemic and Ontological Cognition Questionnaire

EQ – Epistemological Questionnaire

JA – Justification by Authority Belief

RFCP – Revised Family Communication Patterns

SC – Simple and Certain Belief

SES – Socioeconomic Status

TIDE – Theory of Integrated Domains in Epistemology

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CHAPTER 1
INTRODUCTION

Marybeth Hicks (2012), an author and columnist of The Washington Times, suggested recently that a catching radical concept of smart thinking may be a real game changer in the field of parenting in America: the notion to think more about what we do as parents in order to act mindfully to cultivate children who can think smarter. Reflecting on the concept of smart thinking, which is the ability to solve new problems with current knowledge (cf. Art Markman, 2012), she wrote that "imagine what might happen if we stop parenting by thoughtlessly developing habits over time and instead institute fundamental changes in the way we approach our roles as parents. Suppose we all thought more about what we're doing and used the knowledge we gain in our thinking to do things better". She suggests that the more parents know and practice smart thinking, the smarter they become and the more able they too become in helping their children to think smarter. When parents take time to step back, assess and think about their parenting strategies, there may be a reduction in thoughtless routines and a more mindful form of parenting comes into play; supporting children in their ability to solve problems, live more creatively and be productive (Markman, 2012).

This insight is not totally unsupported by what researchers have known about parenting so far. Effective parenting is now recognized to not be an innate gifting but has been for the last few decades, shown to arise from mindful, reflective, observant learning, effort and practices that are conscientiously and meticulously crafted through day-to-day interactions with children (cf. Ruddick, 1989). Parents learn to think and reflect on their children's needs and actions, and they respond to their children according to this knowledge. It is a process amenable to change and improvement, which speaks to the continuous research and investments made in the formulations and evaluations of parenting programs and instructions (cf. Golding, 2000; Miller & Sambell, 2003). But the reality of parenting is that very often parenting practices become routine-like and habitual, and parents become less thoughtful about their use of strategies and communication methods. This thoughtlessness can also be evoked by parental beliefs, goals and individual dispositions. The family falls comfortably into a stable cycle of easy routines, and thus children may not receive the most optimal environment to foster good and smart thinking. Therefore, there is a need for the identification and support of

parenting practices and communication strategies which can contribute to providing these conditions for children to flourish in their ability to think effectively.

This line of thought aligns itself well with the current educational climate where educators are being made increasingly aware of the value of educating for a thinking generation (cf. Kuhn, 2005, 1991). Amongst other commonly acknowledged educational goals of instilling knowledge and developing skills, Kuhn (2005) emphasizes that education has to be for thinking. A thinking education focuses on teaching students how to think reflectively, critically and creatively, and to employ these skills and techniques across a wide spectrum of activities and subjects. She notes that a great deal of evidence reveals that students pass exams through means of drills and rote-memory exercises with the consequence that little thinking is applied in the accumulation of superficial knowledge where no reflection has occurred regarding its value or meaning. Therefore a refocusing of educational goals is critical and essential to ensure that schools foster high quality deep learning with an emphasis on thinking skills as opposed to superficial learning with little value.

Kuhn (2005) focuses on two core components of thinking that education should focus more on: the development of skills of inquiry and argument. These skills, individually and collectively, are indispensible "to produce individuals who can thrive in and contribute maximally to a democratic society… and to value these activities as the soundest path to achieving goals, solving problems, resolving conflicts, and maximizing individual and group welfare" (Kuhn, 2005, p.14,). These intrinsically valuable skills extend beyond school boundaries for children to "develop the ability to make informed decisions, to exercise judgment and to regulate their own behavior" (Bradley & Corwyn, 2000, p.248). They are essential for children to emerge as healthy, well-functioning adults capable of meeting society's requirements for work, social relationships and responsibility

Future generations have to be supported and moulded to become good and effective thinkers. Inherent in the ability to think well lies two individual factors which can shape and improve one's thinking ability. These concern the individual's skills of informal reasoning and his/her personal epistemological beliefs.

Informal reasoning consists of reasoning processes applied to ill-structured problems that have shifting uncertain premises, commonly of an everyday nature. This

type of reasoning is more reliant on background knowledge and experience, compared to formal reasoning processes which often result in definite conclusions deduced from well-structured premises of the problem. Problems utilizing informal reasoning may also not consist of one right solution. The use of informal reasoning occurs frequently in daily life; in mundane daily matters such as deciding which box of chocolates to buy at the supermarket, to issues at the school and community level such as dealing with school bullying, and to larger issues which have societal consequences and implications in everyday life such as the casting of a vote during government elections.

So what forms informal reasoning? Skills of argument are postulated to be the core of informal reasoning (Means & Voss, 1996). The power of argument lies in its inherent value to be a model of knowing in children's current and future lives; active and frequent engagements in authentic arguments, be it collaboratively in discourses or solitary reflections, can lead individuals to interiorize the structure of argument as a framework for their own thinking (Kuhn, 2005). In our highly complex and rapidly changing technological society, knowledge is highly accessible through various channels and vast amounts of knowledge are instantly made available at the click of a computer mouse. This highlights the increasingly crucial role of good reasoning skills for the effective and efficient filtering of these vast amounts of information; to manage, regulate and to evaluate knowledge claims as accepted knowledge has a huge influence on one's beliefs and behaviors. The exercise of argument skills enriches individuals both individually and collectively as it equips them to engage effectively in local and global issues (Kuhn, 2005); to have the competence to weigh the pros and cons of multiple and conflicting viewpoints in order to reach a reasoned conclusion with well thought-out justifications. Skills of argument in informal reasoning are means to the end of knowing, and when they are frequently engaged and refined, they yield their own rewards in the pursuit of reasoned knowledge.

Galotti (1989) writes that "good thinking (i.e. reflective or critical)… involves dispositions (e.g. to be open-minded) as well as skills". Thus other than the development of argumentative reasoning skills which are intrinsically and instrumentally valuable for the exercise of good thinking, there is also a need to inculcate dispositions which may be beneficial to reasoning and thinking. Kuhn (1991) found that some sort of implicit epistemological theory exists behind the development of reasoning skills which even the individual may be unaware of. These epistemological theories are concerned with the

nature and justification of human knowledge (cf. Hofer & Pintrich, 1997). Do individuals see knowledge as fixed, certain and unchanging as opposed to it being dynamic, complex and evolving? Are the claims of experts sufficient to justify knowledge claims, or are personal observations and experiences more reliable forms of justification?

Recent studies have shown that more sophisticated epistemological beliefs are associated with higher argumentative reasoning skills in controversial everyday issues (Mason & Scirica, 2006; Kuhn, 1991, 2005). The progress of epistemological thinking is postulated to provide an essential foundation for the emergence, development and consolidation of effective intellectual values, although it may not automatically yield the value of intellectual engagement. Individuals who believe knowledge is fixed, concrete, simple and static may lack reasons to engage in sustained intellectual inquiry as there is no value in the evaluation of knowledge claims since these claims are already perceived as direct observations of unchanging external reality. It is only at more advanced epistemological positions where knowledge is recognized to be subjective, relative and changing that critical thinking and intellectual skills are recognized as essential for justifying and supporting knowledge claims. Therefore, epistemological beliefs prepare the foundation for individuals to see the value of inquiry and debate as a means of making informed reasoned choices between conflicting knowledge claims (Kuhn, 2005).

Perkins, Faraday and Bushey (1991) made a differentiation between a critical and a makes-sense epistemology. In contrast to having a makes-sense epistemology where individuals only seek to ensure that given information fit well together with prior beliefs using the simplest explanations, a critical epistemologist goes beyond to seek further information and experiences which may be inconsistent with prior beliefs. A makes-sense epistemologist works hard to avoid incongruities in order to hold on to the stability of prior beliefs but critical epistemologists actively seek to create a deeper understanding of the situation by working through the constraints, implications and options of a difficult situation. A critical epistemology is postulated to predict better reasoning, as a critical epistemologist "incorporates more epistemic feelings and values about objectivity, fair play, the importance of taking multiple perspectives and so on" (Perkins, Faraday & Bushey, 1991, p.100), and thus is more willing to engage with controversies incongruent with prior beliefs and in employing higher-level reasoning strategies such as a more thorough search for inconsistencies of information and experience and the seeking of alternative means of explanations and counterarguments.

"The habits of the critical epistemologist equip him or her for even the most difficult of decisions. These decisions cannot, of course, be made easily, but by being able to generate several alternatives and consider more than one point of view, *a person can feel satisfied that he or she has made a reasonable decision*. A well-reasoned decision is less likely to produce surprise or impotence in the face of its consequences. Further, if we grant that people do really make the meaning that is experienced in one's life, then it is clear that critical epistemologists, individually and collectively, *generate qualitatively different kinds of lives* than makes-sense epistemologists. Critical epistemology leads to the construction of experience that is richer in possibilities and more manageable... their better models of the world *afford more perspective, variety and control over fate and fortune*" (Perkins, Faraday & Bushey, 1991, p.101, *emphasis* by the author).

Therefore, a more advanced critical epistemology is not only beneficial to build better reasoning skills and to lay the foundation for intellectual values, but it is also postulated to lead to richer experiences in life whereby one perceives a higher sense of self-efficacy and agency. "Perceived self-efficacy is concerned with people's beliefs in their capabilities to perform in ways that give them some control over events that affect their lives" (Bandura, 1997, p.181). A critical epistemology predisposes the individual towards a stronger belief in his/her own capability to make good reasoned decisions in the face of problems and limitations. With the perception that the final decision made and the subsequent actions taken were the most effective with regards to the situational constraints, the individual gains a sense of subjective well-being which in turn also enhances his/her perceived self-efficacy. Bandura (2001) considers self-efficacy as the most crucial mechanism of agency as "unless people believe they can produce desired results and forestall detrimental ones by their actions, they have little incentive to act or to persevere in the face of difficulties" (p.10). Thus agency, that is the power to initiate action for given purposes (Bandura, 2001), and to do so "in line with his or her conception of the good" (Sen, 1985, p.206) is also enhanced by the relation between critical epistemology and self-efficacy. Additionally in order to achieve agency, the conceptualization of valuable goals in line with what individuals "value and have reason to value" (Sen, 1985, p.204) entails reflective and assessment skills; a process in which skills of reasoning and a critical epistemology are also significantly implicated in.

Therefore thinking skills and dispositions which are amenable to change deserve greater attention because a greater understanding of their development can enable educators and psychologists to ensure better conditions for more optimal flourishing of these fundamentally important capabilities of effective thinking. Formal reasoning which mainly involves deductive reasoning skills with well-structured problems has been a focus of cognitive psychologists for many years, but more work has to be conducted in the area of informal reasoning where reasoning occurs in everyday problems of ill-structured content and relies more on the use of background knowledge and experience rather than fixed given premises. If children are trained to think well, that is in this context, to have enhanced informal reasoning skills coupled with a critical epistemological disposition, the implications of these capabilities are far-reaching for their lives. To think and reason well is to "confer an unlimited capacity and inclination to learn and to know" (Kuhn, 2005, p.179). These capabilities can enable individuals to possess a greater sense of self-efficacy and agency; notions which are significantly related to the expansion of well-being.

There is therefore a need for a greater understanding of how these outcomes are fostered in different settings. Compared to empirical studies dealing with the role of teachers and schools in the development of these two areas, the role of parents within the family has been far less explored. To foster a thinking child also requires a thinking parent. Incidentally, the epistemological beliefs of parents have also been found to influence their parenting strategies and child development beliefs. Parents who have more advanced representations of knowledge and knowing hold a more complex and multi-faceted view of child development, and are more inclined to make use of more effective authoritative parenting strategies (Bond & Burns, 2006). Additionally, they prefer learning academic goals for their children as compared to performance goals (Ricco & Rodriguez, 2006). Therefore, parents' representations of knowledge and knowing have associations with their choice of parenting goals and strategies. Having more sophisticated epistemological beliefs may enable them to be more mindful, evaluative and reflective of the way they parent. Hence, there is a need to further investigate the relation of these parental beliefs with the parenting process and if the relation stands, to ponder on practical ways which can be implemented to support these knowledge beliefs of parents in the hope of shaping them for more effective and mindful thinking.

The current dissertation has two aims focusing on two aspects of children's thinking where the effects of family and parental socialization have been less explored. The first aim is to formulate informed theoretical models based on the findings of current literature on the basis of three objectives: 1. to explore the influence that familial variables have on two associated child outcomes - children's informal reasoning skills which has an inherent emphasis on argument skills and children's personal epistemological beliefs, 2. to test the significance of this association between children's informal reasoning skills and their personal epistemological beliefs as demonstrated in previous studies, and 3. to investigate if familial factors can significantly mediate the direct effects of socioeconomic status, a factor which is empirically established to affect family and parenting factors, on these child outcomes. The second aim is to empirically test these models with the use of quantitative statistical analyses and path analyses.

The structure of the dissertation is outlined as follows:

Literature reviews of related fields and concepts to the current work are first presented. In Chapter 2, an overview of the established work in parenting is presented, highlighting the significant role of parents in fostering positive child outcomes. The chapter begins with the introduction of an empirically proven style of effective parenting - authoritative parenting. The empirical support for the consistent relation of authoritative parenting to positive child outcomes is first presented, followed by a discussion on the suggested mechanisms behind the success of this parenting style. In trying to understand how authoritative parenting works, some researchers have suggested disaggregating the style into its components. This leads on to the following discussion on the two approaches which are used to conceptualize parenting work: the typological approach and the dimensional approach. Two well-established parenting models – Baumrind's typological model of parenting styles and the dimensional approach of Self-Determination Theory and parenting – are then used as elaborations of these respective approaches. The origins, formulation and development of each model are discussed with its relevant empirical studies. Some critiques of the models are also presented. To conclude this section, it is firmly established from past literature that parents play a vital role in supporting and fostering their children's competence in a wide variety of domains, and this process has long-term consequences for the psychological and relational functioning of the children. Therefore, the impact of parenting is hypothesized to also hold true for the fostering of

children's informal reasoning skills and personal epistemological beliefs, although empirical studies attesting to this influence have been few.

Chapter 3 and 4 present the literature review and the definitions of the outcome constructs of interest for the current dissertation – informal reasoning and personal epistemology. The literature on informal reasoning is first reviewed, followed by the literature on personal epistemology.

In Chapter 3, informal reasoning is contrasted with formal reasoning in order to make clear its definition as "a goal-dependent process that involves generating or evaluating (or both) evidence pertaining to a claim or conclusion... which assumes importance when information is less accessible, or when problems are more open-ended, debatable, complex or ill-structured, and especially when the issue requires that the individual builds an argument to support a claim" (Means & Voss, 1996, p.140)". In the next part, the literature presents children and adolescents as capable reasoners, though in need of scaffolds in order to achieve higher levels of competence. Empirical studies reveal that their arguments are often limited and non-critical, displaying shallow engagement with information and less use of strategic and flexible argument skills. What then is needed for the support and development of argumentative informal reasoning? Reasoning is suggested to take place with introspective reflection and social learning. Parents can use conflict talk and casual family discussions to engage children in reasoning practice using social dilemmas faced in daily life. Family communication patterns in the forms of conversation- and conformity-orientations are also discussed as influential in the shaping of children's communication and reasoning skills. Family studies are noted to be scarce as compared to classroom studies in the improvement of children's reasoning skills. Hence, findings from classroom studies are shortly touched on to highlight that reasoning skills can be advanced through interventions which make use of collaborative dialogic learning and explicit reflection behind argument structures.

In Chapter 4, the debates regarding the conceptualization of personal epistemology are first presented, whereby it is defined in the current work as beliefs of the nature of knowledge and knowing regarding the simplicity, certainty, source and justification of knowledge (Hofer & Pintrich, 1997). There exists a variety of personal epistemology models and theories but only those which are relevant for the current work in terms of its sample (i.e., children and adolescents), and content of methodology (i.e.

links with reasoning and thinking) are reviewed in this section. These models are subsequently divided into three parts: a) developmental models, whereby the dimensions of personal epistemology are structurally integrated, coherent and develop together in a logical sequenced process, b) multidimensional models, whereby different dimensions can develop at varying speeds and does not proceed in a stage-like structure, and c) integrated models, which have characteristics of both developmental and multidimensional models. The formulation and defining characteristics of each model are briefly presented. Next, the literature on the development of personal epistemology is reviewed. The general consensus lies in the agreement that development undergoes transformation from a dualistic absolute view of knowledge as being right or wrong to a view of relativism where knowledge is self-constructed and open to different interpretations and then to a position of evaluativistic rationalism, whereby even in a relativistic context, individuals realise that they are able to make their own personal judgments and commitments. Development is postulated to be recursive, occurring especially at stressful transitions of education. Studies regarding the role of family in the fostering of personal epistemological beliefs are presented, highlighting the scarcity of empirical work in this area. Additionally, the relations of parental personal epistemology and parental practices are also explored.

Chapter 4 closes with studies concerning the association of reasoning skills and personal epistemological beliefs. Recent research in scientific reasoning which is mainly restricted to the school domain has evidenced this link but in the current work, only literature which involves reasoning with problems of an informal everyday nature is reviewed.

Chapter 5 presents the research model postulated by the current work on the basis of what is known from literature. The chapter begins by noting the research problems glimpsed from the literature review. The first concerns the scarcity of family-based research in both informal reasoning and personal epistemology development. The second is the need for a more informed understanding of the skills of informal reasoning implicated in everyday life as compared to formal reasoning with well-structured problem material which has been a prominent topic of cognitive psychologists for many decades. The third and last concerns the significant relation of reasoning and epistemological beliefs evidenced in many studies of scientific reasoning and the need to further investigate this within the domain of informal reasoning. In response to the

research problems highlighted above, a conceptual framework was formulated regarding the fostering of reasoning skills and epistemological beliefs of children within the family. The choice and rationales behind the instruments to measure the outcome constructs are first explained. Greene et al. (2008) Epistemic and Ontological Cognition Development Model and instrument (Greene et al., 2010) was used to measure and interpret personal epistemological beliefs. For informal reasoning, two measures of evaluative skills of argument adapted from the study of Means and Voss' (1996) were used. Family variables for this study consisted of four parenting dimensions and two family communication patterns. Subsequently, the main research questions and specific hypotheses are formulated in structural models for empirical testing. The four research questions are as follows:

> *Question 1*. Do familial variables such as parenting practices and family communication patterns influence children's informal reasoning competence?
>
> *Question 2*. Do familial variables such as parenting practices and parental epistemic and ontological cognition beliefs influence children's epistemic and ontological cognition beliefs?
>
> *Question 3*. Are dimensions and developmental positions of children's epistemic and ontological cognition beliefs significant predictors of their reasoning skills?
>
> *Question 4*. Can familial variables be significant mediators of the direct relationship of socioeconomic status on children's reasoning skills and epistemic and ontological cognition beliefs?

The chapter closes by stating the two broad research aims of the current work: to formulate informed theoretical models from literature on relations between parenting and children's informal reasoning skills and personal epistemological beliefs, and to test these models empirically using path analyses and quantitative data analyses.

Chapter 6 explains the methodology of this dissertation. This includes the participants involved, materials used and the standardized procedure employed for data collection. Chapter 7 presents the results from analyses conducted on the data. These include preliminary analyses consisting of descriptive statistics and correlations of the variables used. This is subsequently followed by the results of the structural models which are empirical formulations of the research questions subjected to path analyses.

Chapter 8 discusses the empirical results found. First, results corresponding to the four research questions are presented. This is followed by a general discussion, which provides a comprehensive reflection of the most significant findings, along with the limitations of the current work and the future directions which can be derived from these results.

Chapter 9 concludes the current dissertation by reinstating the aims, the findings, and the contributions of the significant results to the fields of parenting, informal reasoning and personal epistemology. It is expected that the current work will contribute to the developmental literature in terms of bringing a clearer informed understanding of the fostering of children's informal reasoning skills and personal epistemological beliefs in the context of parental socialization, and to confirm and elaborate on the literature concerning the association of the two outcome constructs. Furthermore, the wider implication of this expected knowledge contribution is the practical suggestions it may contain to aid psychologists and educators in supporting parents for the nurturance of children who can think effectively and in doing so, thrive and flourish in their personal lives and in the greater society.

CHAPTER 2
PARENTING

2.1 Competent Parenting – Authoritativeness and child outcomes

Authoritative parenting is one of three parenting styles coined by (Baumrind, 1971), whereby "each of the three parent configurations is a prototype, that is, a complex exemplifying the distinctive features of the group, as well as an explicit description of parenting behaviors that characterize each group member (Baumrind, 2005, p62)". Parenting styles are constellations or aggregates of parental behaviors and attitudes that describe parent-child interactions over a range of situations. Each parenting style is an overarching emotional climate where specific goal-directed behaviors, through which parents perform their parental duties, and non-goal-directed behaviors, such as gestures, changes in tone of voice or spontaneous expression of emotion, are expressed (Darling & Steinberg, 1993).

In the last four decades, authoritative parenting has produced a remarkably consistent picture of the successful socialization of children, though its beneficial influence has been challenged in terms of its applicability across cultures and socioeconomic classes. Authoritative parenting is defined by a host of distinctive features. Authoritative parents balance high nurturance and high demands with clear communication about what they require of the child (Baumrind, 1971, 1975, 1991, 2005). In terms of high nurturance, they are actively responsive to the emotional needs of the child, providing the contingent warmth, support and positive affirmations the child needs. In terms of high demands, they set clear rules and standards and enforce them consistently. They are not fallible to child coercion and shape child's behavior through these clear boundaries. However, they do not use intrusive disciplinary techniques which emphasize control and conformity. Instead, through bidirectional communication, they clearly establish their rules and expectations while proactively explaining the rationales behind them and the consequences when the child does not meet them. They use non-intrusive firm disciplinary techniques such as reasoning when giving directives or sanctions to gain compliance. There is an encouragement of verbal give-and-take while the child's autonomy and expressions of individuality are valued, encouraged and considered.

Children and adolescents from authoritative families have consistently evidenced higher scores in a variety of measures on competence and well-being as compared to peers raised with other parenting styles, namely authoritarian, indulgent or neglectful parenting. Academically, children and adolescents who have authoritative parents demonstrate higher school achievement and stronger school engagement (Gray and Steinberg, 1999; Steinberg, Lamborn, Darling, Mounts & Dornbusch, 1994; Steinberg, Lamborn, Dornsbuch & Darling, 1992). They are more cognitively motivated and achievement oriented. Additionally, this relation between parenting styles and school performance is partially mediated by parents' involvement in school-related activities (Wild & Wild, 1997). In psychosocial functioning, children from authoritative homes are better-adjusted, demonstrating higher empathy, higher self-reliance, self-efficacy and self-esteem, higher resistance to peer pressure and better self-regulatory skills (Baumrind, Larzelere & Owens, 2010; Gray and Steinberg, 1999; Steinberg, Blatt-Eisengart & Cauffman, 2006; Steinberg, 2001; Baumrind, 1991). They are described as socially competent, more cooperative and more responsible. They are also seen as more agentic and possess an internal locus of control. With regards to behavioral problems, these children are less likely to engage in antisocial behavior and display fewer internalizing problems such as anxiety and depression, and externalizing problems such as drug use and aggression (Baumrind, Larzelere & Owens, 2010; Gray and Steinberg, 1999; Steinberg, Blatt-Eisengart & Cauffman, 2006; Steinberg, 2001; Baumrind, 1991).

Darling and Steinberg (1993) pointed out that the association between authoritative parenting and positive child outcomes was present in works as early as Symonds (1939), whereby there was a classification of 'model children' as socialized, cooperative, friendly, loyal and emotionally stable. Similarly, through the use of cluster analysis on data of children's behaviors, Baumrind (1971) identified a group of children of whom she classified as 'instrumentally competent': socially responsible, secure and well-adjusted children. On further investigation, Baumrind (1971) and Symonds (1939) both noticed the consistent association between certain parenting practices and child outcomes. Parents of these instrumentally competent model children were found to share similar practices and behaviors – they were warm, established clear, rational guidelines while allowing the child autonomy within those boundaries, and clearly communicated both their expectations and reasons behind them.

However, the establishment of the relation between authoritative parenting and positive child outcomes does not explain the process in between; how the similar characteristics of parents in this group work to shape child behavior, influence child development and produce good outcomes. Baumrind (1967) suggested early on that authoritative parenting altered how open children are to their parents' attempts of socialization by enhancing the value of parental reinforcement. The parent-child relationship is dynamic and through clear articulation of desired and prohibited behaviors, children acquire the sensitivity and discernment to select the correct responses to parental demands. Authoritativeness alters child characteristics to be more open and willing for parental socialization, thus increasing the effectiveness of parenting strategies, which in turns strengthens the parents' abilities to act as socialization agents. Steinberg (2001) elaborated that "authoritative parenting works because it does three things: the nurturance and parental involvement makes the child more receptive to parental influence, enabling more effective and efficient socialization; the combination of support and structure facilitates the development of self-regulatory skills, which enables the child to function as a responsible, competent individual; and the verbal give-and-take characteristic of parent-child exchanges in authoritative families engages the child in a process that fosters cognitive and social competence, thereby enhancing the functioning outside the family (p.10)". Durkin (1995) emphasized that in the domain of academic achievement, the bidirectional open communication characteristic of authoritativeness provides children with explanations for directives, a sense of awareness and understanding of parents' goals, values and expectations and nurtures important interpersonal skills which help children to succeed in school, both socially and academically.

Furthermore, authoritative parenting is also seen as adaptable to individual child characteristics (Hart, Newell & Olsen, 2003). The flexible use of defining characteristics of authoritativeness, in terms of warmth and involvement, non-coercive reasoning-oriented disciplinary techniques and the provision of autonomy support, can be adjusted to match optimally to each child's individual temperament and his/her unique set of strengths and weaknesses. Authoritative parenting is perceived as an emotional climate which can be individualized to benefit the child. Hart et al. (2003) quoted Kochanska's (1997) work which indicated that while more anxious-fearful children can benefit more from gentle, reasoning-oriented regulation of authoritative parenting, non-fearful anxious

children can benefit more from the aspects of greater parental acceptance and sensitivity. Additionally, more impulsive or resistive children become more manageable with greater rather than with lesser exposure to regulatory limit setting. For difficult children, non-punitive regulation appears to be particularly salient when accompanied by warm and supportive parenting.

Thus, the benefits of authoritative parenting have been attributed to its high parental involvement in altering children's openness and receptiveness to parental socialization efforts, its combination of support and structure for the facilitation of self-regulatory skills, its bidirectional communication for the fostering of both cognitive and social competence and its flexible adaptability of various characteristics to child disposition. Different components of authoritative parenting have been theorized to play different roles in various areas of child development and socialization processes. Viewing authoritative parenting as a typology allows focus to be placed on parenting pattern variations in their general organization and climate of parenting, and the relations of these patterns to child development aspects. Typologies can be convenient to systematically characterize certain aspects of family functioning, serving not only to describe but to predict, explain and prescribe important family processes and outcomes associated with various family types (Koerner & Fitzpatrick, 2002). However, as a typology consists of a host of distinctive features, the explanatory mechanisms for its relations to outcomes may be more difficult to identify and ascertain as there is more than one variable which may have causal influence on these outcomes.

Thus, disaggregating the complex of authoritative parenting may provide a deeper understand to the relations of parenting components, both individually and interactively, to child development outcomes. Through the literature, three core characteristics of competent parenting have been consistently mentioned (Hart, Newell & Olsen, 2003): (a) the degree of parental warmth, support and involvement shown to a child such as the acceptance, affection, time and nurturance that parents dedicate to their children, (b) the degree of behavioral control exercised by parents through clear limit settings and supervision, and (c) the degree of psychological autonomy-support by employing non-intrusive and coercive discipline and encouraging child's individuality, acknowledging child's opinion, giving choices and valuing child input. These three dimensions of competent parenting have also been respectively referred to as connection, regulation and autonomy-granting (Barber & Olsen, 1997).

Gray and Steinberg (1999) attempted to empirically disaggregate authoritative parenting into its three components and found, through a series of hierarchical regression analyzes, that separate components of authoritative parenting facilitated different psychological processes in adolescents and interactively, they worked in combinations to exert influence on child outcomes. The three components which they tested are similar to those mentioned above, namely parental involvement, behavioral control and autonomy-granting. Academic success, measured through grades and academic self-image, was found to be significantly influenced by all three components, with the most benefit gained from high parental involvement, high autonomy-granting and modest levels of behavioral control. With regards to behavioral problems, higher behavioral control and parental involvement was significantly associated with fewer problems. Interactive analyses revealed that high parental involvement and high autonomy-granting were compensatory for the lack of the other component in the prevention of internalizing problems. For psychosocial development, parental involvement and autonomy-granting contributed strongly to healthier development, while behavioral control had significant but modest associations. Thus to conclude shortly, high parental involvement made significant contributions to every aspect of development, academically, psychologically and socially, and promoted a global sense of personal well-being. Behavioral control and structure inculcated self-control and discipline in adolescents, acting as a protective factor against externalizing problem behaviors. Autonomy-granting increased self-competence and self-confidence in both academic and social domains, thus fostering greater achievement ambitions and the belief of making them happen. In contrast, the lack of autonomy-granting negatively affected emotional health, in particular by increasing internal distress and stunting psychosocial development. Thus the more parents involved themselves in their adolescents' lives, provided clear behavioral control and high autonomy-support, the more positively adolescents perceived and evaluated their own conduct and development.

The benefits of competent parenting have been shown to be undermined or accentuated by forces outside the family. The peer group is one such influential external force. Fletcher, Darling, Steinberg & Dornbusch (1995) found that the positive effects of authoritativeness were amplified when adolescents had friends whose parents were also authoritative. The neighborhood also acts as an external force which can affect parenting efforts. Studies show that the beneficial influence of authoritative parenting was

enhanced when other parents in the community were also authoritative. This may be attributed to the collective fostering of a more positive peer culture. Additionally, the effects of parental involvement on children's school performance in neighborhoods where other parents were also involved was nearly the double of student performance in neighborhoods where parents were, for most part, not (Cauffman & Steinberg, 1995; Darling, Steinberg & Gringlas, 1993).

The overtime impact of authoritative parenting style has also been investigated in longitudinal studies (Steinberg et al., 1989, 1994, 2001). By modeling if child characteristics predicted outcomes at later time points, results confirmed Baumrind's (1971) earlier conclusion that parenting style was a characteristic of the parent and not the child. Parenting styles instead of child characteristics were found to be significantly predictive of later child outcomes. Although parent-child relationships are recognized as dynamic and reciprocal, these results solidified the notion that authoritative parenting significantly influences adolescent competence rather than adolescent competence determining parenting styles. This highlights the critical importance of competent parenting for optimal child outcomes. The studies also revealed a cumulative effect of the disadvantages of non-authoritative parenting over time – during each year of high school, adolescents from authoritative homes gained a widening advantage over those whose parents are neither responsive nor demanding. Thus it can be concluded that authoritative parenting in preadolescence is "a process that guides young people along a trajectory that leads towards increasing competence and psychological well-being over the adolescence period" (Steinberg, 2001, p.8).

Inclusion rationale of parenting paradigms

It is not within the scope of the current dissertation to give an extensive review of the history and development of theoretical and empirical work related to parenting which has spanned almost five decades. However, for a clearer understanding of the typological and disaggregated dimensional approaches that parenting work can be classified under, Diana Baumrind's parenting typology will be further elaborated in Section 2.2 and the parenting dimensions related to the motivational and socialization theory of Self-Determination Theory will be reviewed in Section 2.3. The reviews will aim to explain the origins and development of each paradigm, and attempt to succinctly summarize their

core concepts. Additionally, to the author's knowledge, these two paradigms are not often linked together in a single piece of work, though in parenting literature, the empirical work generated in these two paradigms can complement and aid each other in deeper understanding of the mechanics of parenting.

2.2 Diana Baumrind's Typological Model of Parenting Styles

Diana Baumrind's tripartite parenting style classification (1967, 1971, 1991, 2005) was a radical change from the factor analytic and circumplex tradition of the early work in parenting research. Her typological approach meant that any one aspect of parenting was dependent on the configuration of all other aspects, unlike the highly-favored approach in parenting literature at that time in which parenting aspects were clearly delineated to separate linear dimensions. Baumrind's three core parenting types were empirically-derived and continually refined from vast empirical data. They have been widely replicated across cultures, spanning a huge repertoire of empirical studies, sealing its importance in parenting literature and attesting to its prolific status. Baumrind's work has thus proven to be highly useful in correlating child outcomes, whether optimal or dysfunctional, to certain types of parenting styles.

Baumrind (1966) first introduced her three parenting styles in a review concerning the effects of discipline on child behavior. She focused on one broad parental function – control, as opposed to dimensions of parenting. Control was defined as parental demands for behavioral compliance of the child as an attempt to integrate the child into the family and society, and was measured by parents' ability to enforce directives, the consistency of this enforcement, the ability to withstand deviant nuisance behaviors such as whining and crying, and the use of incentives and reinforcements. Through the initial analyses of extensive detailed parent-child observations and interview transcriptions with parents of preschool children, Baumrind (1966) noted the consistent associations of different patterns of parental control to various clusters of child behavior. This led her to distinguish between three types of parental control – authoritarian, permissive and authoritative. Subsequent analyses led to two publications the following year (Baumrind, 1967; Baumrind & Black, 1967) which provided further empirical support for these three parenting styles.

Initially concerned with only one central factor of authority and control, Baumrind (1967, 1971) later realized that parents who differed in this factor also tended to differ along other factors, thus providing empirical and conceptual support for the typological approach. Darling and Steinberg (1993) noted that analyses with parenting styles are "more predictive of child attributes than analyses based on specific parenting practices because the influence of any particular parenting practice on child development would easily be lost among the complexity of other parental attributes"(p.488). Baumrind's investigation of parenting practices thus began to extend beyond the single issue of authority to include other factors such as maturity demands, communication style, warmth and involvement (Baumrind, 1967). Maturity demands were teaching demands made by parents to prepare the child for intellectual, social and emotional independence while communication style was concerned with reasoning-oriented patterns for directives, provision of debate opportunities for difficult issues and the directionality of the communication. Lastly, warmth and involvement was the degree of parental affect shown, which encompassed the extent of emotional support, parental time and attention, and the use of positive rewards and reinforcement.

Notably, another interesting shift from earlier parenting models was Baumrind's recognition of the bidirectionality of the parent-child relationship and her efforts to take this into account empirically. By measuring parents' attempts to gain compliance independent of children's actual compliance, Baumrind (1967, 1971) concluded that parenting style was a characteristic of the parent rather than the parent-child relationship.

Characteristics of Baumrind's Parenting Styles

Three parenting styles were conceptualized by Baumrind in her early work (1967, 1971, 1978) - authoritarian, permissive and authoritative. Her later publications revealed more parenting conceptualizations (cf. Baumrind, 1991, 2005; Baumrind, Larzelere & Owens, 2010) but it can be argued that Baumrind's three core parenting styles remained the most influential of her work, having been widely established and repeatedly used as an organizing heuristics for child development research. Baumrind's conceptualizations were mainly data-driven and thus were subjected to changes depending on the sample characteristics such as the age of children. As mentioned before, Baumrind's (1967) initial study used cluster analysis to group children who displayed similar characteristics

and behaviors together. Three groups were identified: the first group was socially detached, passively hostile, vulnerable to stress and easily distressed; the second was relatively immature, displayed impulsive behaviors and aimlessly pursued activities; and the third was the most self-controlled, self-reliant, socially and emotionally competent. Subsequently, these three clusters of children corresponded respectively with three strands of parenting styles named authoritarian, permissive and authoritative. Authoritative parenting has been elaborated in Section 2.1 above but the following elaborates on the other two types of parenting:

a) *Authoritarian parenting* – parents hold a strict absolute set of standards, and use it to measure and evaluate their child's behavior and attitudes. When children do not comply with these high standards, intrusive disciplinary measures such as love withdrawal and harsh physical punishment may be enforced to obtain his/her obedience. Bidirectional communication is not encouraged and parents tend not to practice reasoning when giving directives. Children's autonomy and expressions of individuality are not actively encouraged, in keeping with their emphasis on the traditional hierarchy of order within the family, valuing obedience to and respect for authorities. They are less contingently responsive to the needs of the child and demonstrate less explicit expressions of positive affect - they are less warm, less approving, less empathetic and less sympathetic.

b) *Permissive parenting* – parents do not have high demands and do not expect their children to live up to these demands. They are overly lax with rules and expectations and provide little structure and consistency in their disciplinary methods; often not seeking to guide or correct misbehaviors. Rather, the child is allowed to self-regulate his/her own activities as much as possible. Parents are highly responsive and affirmative but overly accepting towards their child's deviant behaviors, impulses and wayward desires. They allow the child to use them as a resource, presenting themselves neither as a role model for him/her to emulate, nor as an active agent with authority to shape the child's behaviors.

Children of authoritarian parents have been found to exhibit less psychosocial maturity such as low self-esteem, lack of empathy and temperance, low communal competence, low agency and more internalizing problems such as depression and

anxiety. Academically, they also display poorer performances compared to peers from authoritative families (Baumrind, Larzelere & Owens, 2010; Steinberg & Blatt-Eisengart, 2006; Baumrind, 1991). These negative child outcomes have been attributed to the coercive disciplinary techniques of authoritarian parenting, which have been found to undermine children's autonomy and development. However, adolescents of ethnic minorities or lower social classes, such as Asian-, African- or Latin-American adolescents, have been found to benefit from authoritarian parenting in the domain of academic achievement (Leung et al., 1998; Dornbusch et al., 1987). Steinberg (2001), however, argued that evidence for the benefits of authoritative parenting is stronger, having been empirically replicated across the world, with empirical studies supporting its usefulness beyond ethnicity and socioeconomic status (cf. Steinberg, Mounts, Lamborn & Dornbusch, 1991). Steinberg suggested that this difference in results may be due to minority adolescents being less affected by authoritarian parenting compared to White peers but this does not necessarily indicate that they benefit more from authoritarian parenting. He supported his conclusion with evidence that minority adolescents raised in authoritative homes still exhibited higher competence and maturity compared to peers from non-authoritative homes. Baumrind, Larzelere and Owens (2010), however, interpreted these results in a different way. They postulated that authoritarian parenting should be distinguished from directive parenting. The former and latter are alike in that they are highly confrontive and ideologically conservative, but only the latter remains child-oriented, is moderately responsive and avoids severe levels of verbal and physical discipline. Thus directive parenting is confrontational but not coercive, thus perhaps providing an explanation that authoritarian-like parenting can be optimal in some cultural contexts.

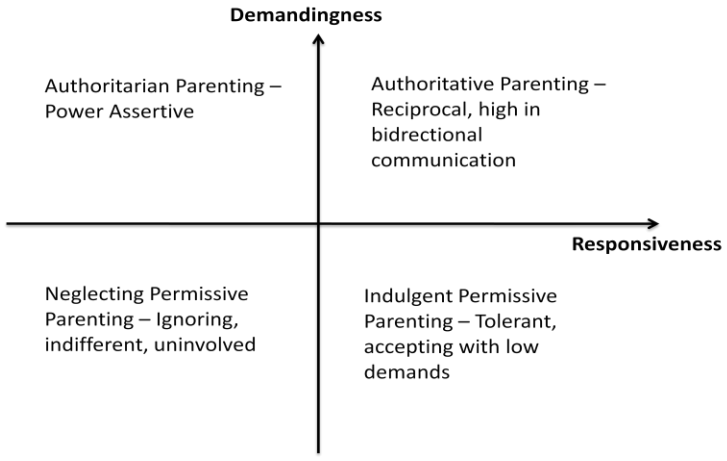
Children of permissive parents have similarly been found to be less well-adjusted and less well-performing compared to children of authoritative parents. They are less academically competent and lack self-regulation and social responsibility. Additionally, they are shown to be more prone to delinquency; being more vulnerable to antisocial behavior and externalizing problem behaviors such as drug use (Steinberg & Blatt-Eisenberg, 2006; Baumrind, 1991). In later work, permissive parenting is further specified into indulgent permissive and neglectful or disengaged permissive parenting (Maccoby & Martin, 1983; Baumrind, 1991). These two sub-types of permissive

parenting and their respective consequences on child development will be further elaborated on in a later section.

This tripartite classification of Baumrind has generated many empirical studies, most notably by Steinberg and colleagues (cf. Steinberg, 2001). These studies have validated and supported the effectiveness of authoritative parenting and by the early 1980s, Baumrind's classification was firmly established in the field of child development. However, researchers around this time also began to recognize the restrictions of Baumrind's classification methodology in that her typology was specifically formulated for the purpose of differentiating among children reared in well-functioning middle-class European American families (Baumrind, Larzelere & Owens, 2010). There was a growing interest in a broader range of parenting variations and researchers started to question the applicability of Baumrind's model beyond these well-functioning families.

Maccoby and Martin (1983) facilitated the generalizability of Baumrind's model to other populations by transforming her typological approach back into a circumplex linear formulation alike to earlier parenting work. By defining parenting along two linear dimensions, these theoretically important aspects of parenting can now be measured in various populations.

Figure 2-1. Maccoby & Martin's dimensional model of parenting



Two specific processes underlying parenting were conceptualized: (a) demandingness – the number and type of maturity demands made by parents and (b) responsiveness – the contingency of parental reinforcement. Parental responsiveness is not the equivalent of warmth or positive affect as Maccoby and Martin (1983) noted: "the concept differs importantly from that of warmth, which includes affection or praise when they are

contingently but also when they are given on the parent's impulse regardless of the concurrent state, signals, and behavior of the child" (p.39). Figure 2-1 illustrates Maccoby & Martin's (1983) two dimensional model.

As can be seen in Figure 2-1, authoritative parents score high on both measures of demandingness and responsiveness. They have high expectations of mature behavior from their children, but also respond contingently to the needs of their children through the dedication of time and resources. Authoritarian parents score high on measures of maturity demands but low on measures of responsiveness. They demand children to behave maturely, but do not provide appropriate responses to satisfy children's needs of affirmation and guidance. With regards to the permissive parenting style, Maccoby & Martin (1983) made a distinction between two types of parenting which could fall under this category – the indulgent permissive parent and the neglecting permissive parent. Indulgent permissive parents score moderately high on measures of responsiveness and low on measures of demandingness but neglecting permissive parenting, similar to Baumrind's 'neglecting' style, are low on both measures of control and responsiveness. For further elaboration:

- Indulgent permissive parents make few or almost no demands for mature behaviors but they are highly responsive to their children's needs. However, they are overly tolerant and accepting towards the child's deviant behavior and wayward impulses, including sexual and aggressive ones. They avoid asserting their authority and use as little punishment as possible. They allow children to self-regulate and make their own decisions when at all possible, and impose no controls or restrictions to govern the child's schedule.

- Neglecting permissive parents, alike to indulgent parents, make no maturity demands but unlike them, have no response to their children's needs. If there is an unavoidable immediate need to respond to, they seek to minimize their time and interactions with the child by responding in such a way as to terminate the need and primarily orientate their behavior towards the avoidance of inconvenience.

However, Maccoby and Martin (1983) cautioned that their linear reformulation does not directly corresponds to Baumrind's model as its two dimensional structure does not include assessments of other distinguishing features of Baumrind's parenting style such as the quality of parental control, warmth and affection given, coerciveness of discipline

and autonomy granting practices. Nevertheless, their reformulation allowed for the measurement of quantitative differences in parenting practices and was highly useful for expanding the scope of Baumrind's classification. Baumrind (1991) also adopted these dimensional concepts of demandingness and responsiveness in her later work and elaborated that: “Demandingness refers to the claims parents make on the child to become integrated in the family whole by their maturity demands, supervision, disciplinary efforts and willingness to confront the child who disobeys. Responsiveness refers to actions which intentionally foster individuality, self-regulation and self-assertion by being attuned, supportive and acquiescent to the child’s special needs and demands (p.61-62).” She postulated that demandingness represented the demands a society made on the child (as conveyed through the parent’s socializing role) and contrastingly, responsiveness represented the demands the child made on society. Competent parenting was found in the balance parents made between responsiveness and demandingness; in other words, “how children balanced other-oriented, rule-following tendencies with individualistic, autonomous, active thinking” (Darling and Steinberg, 1993, p.492).

Baumrind (1991) observed that neglecting or disengaged parents had children who had the lowest social and psychological adjustment and academic competence as compared to their peers. These children generally lacked social regulation, social responsibility, and cognitive competence, suffered from internalizing and externalizing behaviors and rejected their parents as role models. They suffered from the highest level of externalizing problems of drug use and alcohol abuse. Academically, they performed poorly on achievement tests and possessed an external locus of control (Baumrind, 1991).

In Baumrind's later work, seven parenting types were derived from differentiations among the earlier three patterns (Baumrind, 1991; Baumrind, Larzelere & Owens, 2010). These seven patterns are elaborated in Table 2-1. Although Baumrind (1991; Baumrind et al., 2010) has used these seven typologies in later studies, many empirical parenting studies have continued to use the three main prototypic types of parenting established in her earlier work, namely authoritative, authoritarian and permissive parenting

Table 2-1. Baumrind's Seven parenting types

1. Authoritative	Highly demanding, responsive, autonomy-supportive and low psychological control	Authoritative (demanding and responsive)
2. Authoritarian	High-psychologically controlling, high-demanding, and low-responsive	Directorial (more demanding than responsive)
3. Directive	High-demanding and moderate-responsive	
4. Permissive	Low-demanding and high-responsive	Lenient (more responsive than demanding)
5. Democratic	Moderate-demanding, high responsive, and high autonomy-support	
6. Good enough	Moderately-responsive, demanding and autonomy supportive	(moderate in all)
7. Disengaged	Low-demanding, low-responsive and low-autonomy supportive	(low in all)

Despite its established status, Baumrind's model of typological styles has had its share of criticisms. Lewis (1981) critiqued Baumrind's focus on parental control and her suggestions of the role that control plays in contribution to positive child outcomes. Lewis (1981) argued that the high control used by authoritative parents seemed unlikely to explain and account for this positive association and suggested that although high parental control might obtain external behavioral compliance, it was likely to retard the internalization of parental values. This is in line with findings of SDT that the use of controlling parental discipline interferes with the process of the child internalizing socially desirable values. Rather, Lewis believed that the positive child outcomes Baumrind obtained were a consequence of the respect given to the child and the space for open bidirectional communication provided in authoritative parenting. Baumrind (1983) agreed with Lewis to a certain degree but remained unchanged in her stance that parental control was a necessary ingredient for children to develop instrumental competence. However, the concept of control received renewed attention in later work, with control being differentiated between intrusive psychological control and well meaning behavioral control (Steinberg, 1990).

Grolnick (2003) additionally argued that Baumrind's model lacked contextual emphasis. She argued that parenting situations differed, and with changing situational contexts, children's needs also differed. Thus the effectiveness of parenting strategies could vary in different contexts. She referred to Darling and Steinberg's contextual model

(1993); which interpreted and explained specific parenting practices in the context of a more global parenting style found to enhance or diminish the effects of the practices. Grolnick (2003) noted that control could easily be seen as parental aggressiveness and emphasized that instead of using control, parents should actively support their child's need for autonomy. In valuing child input and supporting their self-initiated behaviors, children are empowered to be more agentic and can flourish developmentally.

Lastly, Baumrind's model has been critiqued for its lack of the concept of 'tolerance', defined as parents having to practice detachment or restraint in certain situations when it is not appropriate to set limits (Greenspan, 2006). Competent parents, even those relatively high on control, need to make judgments all the time about when to and when not to intervene but Baumrind's model does not account for unique situations when parents have to practice tolerance for the achievement of higher purposes. Thus to conclude briefly, Baumrind's model has been criticized on three points: a) parental control as beneficial to child internalization instead of it being rigid and detrimental, b) contextual inflexibility and c) lacking the factor of parental tolerance when parents have to be detached or restrained in certain situations for more effective teaching.

Grolnick, Deci & Ryan (1997), in the book "Parenting and Children's Internalization of Values", pointed out that Baumrind's parenting patterns could be understood in terms of the parenting dimensions outlined in Self-Determination Theory (SDT): "authoritative parenting can be described as a combination of high autonomy support and high structure, while the more controlling authoritarian style involved high levels of both control and structure" (Grolnick, Deci & Ryan, 1997, p.152). Grolnick, Deci and Ryan acknowledged though that the features of authoritative parenting need not be mutually exclusive and can work to affect each other. Parents' active support of autonomy can help increase their involvement and warmth in interactions with children and this involvement can subsequently alter children to be more open and responsive to rules and regulations set by parents. The next section introduces the Self-Determination Theory and further elaborates on parenting research conducted within this theory.

2.3 Self Determination Theory (SDT) and Parenting

The Self-Determination Theory (SDT; Deci, Ryan, 1985, 2000, 2008) is an organismic dialectical approach that uses the concept of innate, universal, psychological needs to explain the process of human motivation and internalization. Strictly speaking, SDT is not considered as a developmental theory as the theory gives little attention to age-related changes in socialization content and practices. However, it has been found to be highly relevant and useful to understanding the socialization of children, their internalization process and their development that entails "individuals' working to elaborate or expand themselves while striving to maintain or enhance integration and harmony among all aspects of themselves" (Grolnick, Deci & Ryan, 1997, p.136).

SDT postulates that there are three basic needs: a) the need for autonomy refers to a natural desire to experience behavior as volitional and freely chosen, b) the need for competence refers to the desire to feel effective and skilful in the activities one undertakes, and c) the need for relatedness refers to the desire to feel connected to others; to care and be cared for (Deci & Ryan, 2000). The satisfaction of these basic needs is assumed to energize, propel and direct human behavior and allows internalization to function optimally. The internalization of values, behaviors and attitudes in the social environment is theorized as a spontaneous process (Ryan, 1995). SDT advocates that these three needs are not automatically satisfied, but requires ongoing support from surrounding social contexts.

Children are assumed to have an innate curiosity and tendency towards actively mastering their environment. Parents are recognized as significant social agents who can successfully facilitate this process and support their children's motivation and engagement in tasks, especially when these tasks are not inherently enjoyable. Internalization - the learning of external social regulations, integrating them into one's sense of self and volitionally performing them without prompts - is viewed as the central socialization goal of parenting (Joussemet, Landry & Koestner, 2008; Grolnick, Deci & Ryan, 1997; Schaefer, 1968). Thus although parents can obtain child compliance to certain adult requirements with force, the real goal of parenting should be for children to accept these behaviors as their own. The social parenting context can either facilitate or undermine children's natural tendencies toward active engagement and psychological growth, or it can catalyze lack of integration and defense. Parents are the socializing

agents that not only must provide the structures to be internalized, but they must also provide an involving positive surround for the child to be willing to engage these structures.

A remarkable finding of SDT is that children are more likely to internalize values and attitudes that are congruent with their intrinsic nature when less, rather than more, pressure is exerted on them (Joussemet, Landry & Koestner, 2008). External pressure that goes against children's developmental tendencies can actually have a negative effect on their development. Therefore, parents have to be sensitive about these thresholds and find ways to promote internalization without diminishing the natural curiosity, creativity, vitality and excitement of the child. When parents succeed in creating optimal supportive surrounds for the fostering of children's intrinsic motivation and internalization, children's learning and psychosocial adjustment greatly benefit and a sense of agency and well-being is achieved.

In SDT, three separate but dynamically related aspects of the family environment form the key components of successful parenting and are expected to have long-term consequences for the psychological and relational functioning of children – *autonomy support*, *structure* and *involvement* (Joussemet, Landry & Koestner, 2008; Grolnick, Deci & Ryan, 1997). In contrast, parental *control* has been found to consistently undermine intrinsic motivation and produce non-optimal forms of internalization. These four constructs will be individually defined in the following sections and elaborated in relations to supporting empirical studies. When relevant, ongoing theoretical debates related to these constructs will also be discussed.

1. Autonomy-support

The need for autonomy is one of three basic needs postulated in SDT and when supported, promotes individuals' internalization, flourishing and well-being (Deci & Ryan, 2000). Autonomy-support refers to the active support of the child's capacity to be self-initiating and to feel that he/she has input in determining behaviors (Grolnick & Ryan, 1989). Autonomy is the experience of freedom in initiating and endorsing behaviors, that is, to authentically concur with the internal or external forces that influence behaviors. Autonomous behavior is volitional, harmonious and integrated functioning, in contrast to more pressured, conflicted or alienated experiences (Ryan, Deci, Grolnick, & La Guardia, 2006; Deci & Ryan, 2000).

Social environments are autonomy supportive when they provide choices, encourage self-initiation, acknowledge perspectives and feelings, provide meaningful rationales and avoid controlling techniques (Joussemet, Koestner, Lekes and Landry, 2005). In parenting, this means the encouragement of parents towards their children to do certain activities with the goal of fostering autonomous self-regulation rather than mere compliance. They value their children's ideas and emotions, and encourage self-initiated expressions of individuality. They abstain from using coercive disciplinary techniques and allow the child to make choices when possible. When an activity is of intrinsic interest to the child, parents only have to avoid using controlling strategies and this is sufficient to allow the developmental process of intrinsic motivation to flourish. However, when activities are not inherently enjoyable, parents have to be more proactive in supporting the child's autonomy by being contingently responsive to his/her needs, considering the child's perspectives and encouraging self-initiated behavior in order to successfully facilitate the internalization of external values, attitudes and behaviors.

There has been debate over the developmental process of autonomy-support and how it should be defined and assessed (Soenens et al., 2007). While SDT researchers conceptualize autonomy-support as the degree to which behaviors are volitionally enacted (i.e., the promotion of volitional functioning), other parenting researchers have defined it as the promotion of independent functioning (Gray & Steinberg, 1999; Silk, Morris, Kanaya & Steinberg, 2003). The opposite of independence is conformity to expectations or dependence on parents for making decisions, but the opposite of volitional functioning is not dependence but heteronomy, that is, the feeling of being controlled in one’s actions by external forces or by internal compulsions. It does not encompass making children fully independent from others, self-reliant and detached. It is fully possible for autonomy to be provided while still being related to others and being reliant on them for support. The promotion of independence primarily pertains to what parents promote (independence versus dependence) rather than to how parents promote autonomy (promotion of volitional functioning). Soenens et al. (2007) showed that these two concepts can be empirically distinguished using confirmatory factor analyses which revealed a better fit of a two-factor model to the empirical data than a one-factor model, supporting the factorial distinctiveness of promotion of independence and promotion of volitional functioning. The results also showed that only the promotion of volitional functioning was a unique predictor of adolescent psychosocial functioning, supporting

the notion that promotion of independence is less strongly related to adolescents' optimal functioning compared to the degree that parents support their children to act upon their true interests and values. Therefore, autonomy support conceptualized as promotion of volitional functioning is more important for adolescents' well-being as opposed to just promoting independence, presumably because it encourages them to be more reflective and aware of their personal interests, goals and values and to act upon them.

Additionally, autonomy-support should not be confounded with permissiveness, that is, the lack of structure, or neglect as the lack of involvement (Joussemet, Landry & Koestner, 2008). Valuing and respecting child input, the encouragement of self-initiated behavior and the provision of choice do not equate to freely allowing the child to do anything he/she wants without any boundaries or guidance.

Fulfilling the need for autonomy has received paramount importance in parenting literature as parental autonomy-support has been shown to be associated with greater internalization and integration of important but uninteresting activities (cf. Joussemet, Landry & Koestner, 2008; Joussemet, Koestner, Lekes & Houlfort, 2004) across various domains of life such as school performance, social competence and job-seeking (Soenens & Vansteenkiste, 2005).

Through videotaped observational studies of parent-child interactions during play- and task-oriented sessions, autonomy-supportive parenting has been shown to foster intrinsic motivation and promote higher social competence in children. Greater task-oriented persistence and competence during solo play sessions of toddlers were found to be associated with higher maternal autonomy-support in contrast to mothers who were more controlling (Grolnick, Frodi & Bridges, 1984). A follow-up study one year later indicated sustained beneficial effects on task persistence of children with autonomy-supportive mothers (Frodi, Bridges & Grolnick, 1985). Koestner, Ryan, Bernieri & Holt (1984) demonstrated that when parents acted in an autonomy-supportive manner to gain child's compliance in which they do not use coercive intrusive methods, compliance can be obtained without adverse negative effects on children's intrinsic motivation. Similarly, Kochanska, Coy & Murray (2001) showed that children of autonomy-supportive mothers displayed higher levels of "committed compliance" across various tasks, that is, the reflection of a genuine adoption of mother's agenda which is considered a preliminary form of internalization and self-regulation. One such task was

the prohibition of the child to touch attractive objects (Kochanska & Aksan, 1995). When mothers used reasoning, polite requests, positive comments, suggestions and distractions, children were more likely to internalize this prohibition and not touch the object when left alone for a few minutes with the prohibited object. However, when mothers used negative control such as giving out threats, harsh physical interventions and negative statements, these children exhibited only "situational compliance" that is, superficial obedience to request, and were more likely to touch the object when left alone. Additionally, higher maternal autonomy-support was positively correlated with child's intrinsic motivation (Deci, Driver, Hotchkiss, Robbins & Wilson, 1993). In two videotaped sessions of play with construction toys accompanied by their mothers, children of autonomy-supportive mothers indicated greater interest and enjoyment.

Children's perceived autonomy-support from parents has also been found to act as a significant mediator between parenting environments and school outcomes. Grolnick and Ryan (1989) demonstrated that the autonomy-supportive practices of parents were positively related to children's self-regulation and higher achievement and competence in school. Grolnick, Ryan & Deci (1991) showed that higher levels of child's perceived autonomy-support from parents were positively associated with children's self-esteem and feelings of competence and autonomy, which in turn predicted their school performance. Maternal autonomy-support has been associated with higher performance on a homework-like task (Grolnick, Gurland, DeCourcey and Jacob, 2002). Subsequent research has also confirmed the importance of perceived parental autonomy-support to adolescents' self-regulated motivation, adjustment and school success (Guay, Ratelle & Chanal, 2008; Exeler & Wild, 2003; Lorenz & Wild, 2007; Vallerand, Fortier & Guay, 1997).

Longitudinally, Joussemet, Koestner, Lekes and Landry (2005) found that early experiences of parental autonomy-support had sustained beneficial effects on children's academic and social achievement. Maternal autonomy-support was coded from interviews about childrearing when children were five years old. The study followed children from age five till nine on measures of teacher-rated academic and social adjustment measures and found that maternal autonomy-support was positively related to social adjustment and academic achievement. Autonomy-support also led to higher overall adjustment as evidenced by children showing simultaneously high competence in both domains. These findings support conclusions of recent studies which suggest that

autonomy-supportive contexts promote consistency and congruence among various behavioral areas and are aligned with SDT's postulation that the fulfillment of autonomy support facilitates integrated functioning (cf. Deci, Eghrari, Patrick & Leone, 1994; Joussemet, Koestner, Lekes & Houlfort, 2004).

2. *Control*

Control here refers to psychological control; coercive, intrusive and manipulative parenting behaviors which intrude upon the child's psychological world (Soenens & Vansteenkiste, 2010; Ryan, 1982) and is characterized by parental hostility and negative affect. This type of control is covert and aims to change the child. Controlling techniques consists of the invalidation of feelings, guilt induction, love withdrawal and creating an environment in which acceptance is conditional and contingent on children's behavior (Barber, Stolz & Olsen, 2005; Silk, Morris, Kanaya & Steinberg, 2003). Controlling parents undermine children's tendencies for autonomous regulation and pressure children to think, behave or feel in particular ways.

While autonomy-supportive practices are related to positive child and adolescent development, control has consistently been found to have detrimental effects on development (cf. Barber et al., 2001; Soenens & Vansteenkiste, 2010), being linked with social withdrawal (Baumrind, 1967), internalizing problems (Silk et al., 2003; Gray & Steinberg, 1999; Barber et al., 1994), and externalizing problems (Barber & Olsen, 1997). In observational studies with infants, controlling communications, defined as maternal vocalizations seeking to change infants' ongoing activity, were found to lead to less task-oriented persistence and competence in children during solo play (Grolnick, Frodi & Bridges). These effects were found to be sustained in a follow-up study (Frodi, Bridges & Grolnick, 1985). Controlling vocalizations have also been associated with lower levels of young children's intrinsic motivation during play sessions (Deci, Driver, Hotchkiss, Robbins & Wilson, 1993). Child compliance to parents' authority was found to be negatively related to power-assertive parenting practices and a lack of internalization was seen (Kochanska & Aksan, 2006). When parents used internal controlling methods such as love withdrawal and guilt induction, children sensed rejection from their parents and expressed resentment towards their parents (Assor et al., 2004; Roth, Assor, Niemiec, Ryan & Deci, 2009). Thus, controlling socialization

practices interfere with child and adolescent development and increase the tendency for child maladjustment.

Baumrind's model was criticized on her assertion that parental control was necessary and beneficial for child development (cf. Lewis, 1981). Later theorizing and research make a distinction between psychological control and behavioral control (Barber, Olsen & Shagle, 1994; Barber, 1996; Steinberg, 1990). Behavioral control consists of parental attempts to regulate and structure child behavior (e.g., manners, study activities and involvement with peers), for instance, through the communication of rules for appropriate behavior and monitoring of child whereabouts (Grolnick & Pomerantz, 2009). Monitoring has been associated with less involvement in delinquency and other norm-breaking behaviors but recent studies have suggested that decreased levels of deviant behaviors may be attributed to child disclosure instead of parental monitoring and surveillance (Stattin & Kerr, 2000; Kerr & Stattin, 2000). In contrast to behavioral control, psychological control consists of the use of manipulative techniques to control the child's psychological experiences (e.g., feelings, aspirations and identity choices) instead of the child's behavior (Barber & Harmon, 2002). Barber (1996) advocated that this distinction allowed for a more fine-grained analysis of how parenting affected child development as behavioral control has been found to be uniquely predictive of externalizing problems while psychological control was uniquely predictive of internalizing problems (Barber et al., 1994; Barber, Stolz & Olsen, 2005). Other studies have also found this positive relation of psychological control to externalizing problems (Barber, 1996) but some studies did not replicate this finding (Gray & Steinberg, 1999).

However, Soenens & Vansteenkiste (2010) noted that the distinction between psychological control and behavioral control as 'control over a child's psychological world' versus 'control over a child's behavior' can be trickier than expected as "there may not be a clear-cut line between psychological and behavioral control, in that parents could use psychological control for behavioral outcomes in children… whereas behavioral control could affect how children think and feel" (Wang et al., 2007, p. 1608). An evaluation of certain assessment scales for behavioral control has supported that these concepts are easily confounded as some items found in behavioral control scales were reflective of psychological control (cf. Soenens & Vansteenkiste, 2010). Despite efforts to theoretically delineate these concepts, there exists the common feature of pressure and coercion when behavioral control involves pressuring parenting tactics such as physical

punishment and threats of withdrawing privileges. As a solution, Soenens & Vansteenkiste (2010) suggested that behavioral control should be used to define "parental attempts to structure and regulate children's behavior" (p.87); a qualitatively different concept from parental control in the sense of pressure and coercion. This is equivalent to the dimension of structure in SDT, which will be further elaborated in the next section.

A last debate worth mentioning is that of intrusive psychological control being equated to the absence of autonomy-support (cf. Steinberg, 1990), implying that control and autonomy-support are opposite ends of a continuum (Barber, Bean & Erickson, 2001). Silk et al. (2003) found factorial validity of two constructs which are empirically distinct from each other rather than opposite ends of one unitary construct. Psychological control, but not autonomy-support, was found to significantly relate to internalizing problems, suggesting that these constructs had different unique influences on adolescent's mental health. However, in order to understand if control is the absence of autonomy-support, one must first clarify about the conceptualization of autonomy-support. Soenens et al.'s (2007) differentiation of autonomy-support into promotion of volitional functioning and promotion of independence helps to support the existence of both perspectives that can be found in empirical literature: autonomy-support as opposite of control, and autonomy-support as distinct from control. Autonomy-support as promotion of volitional functioning is the opposite of psychological control, but promotion of independence can be postulated as relatively orthogonal to psychological control (Soenens & Vansteenkiste, 2010). Parents can promote independence or dependence in a controlling or non-controlling manner. Correlation analyses confirmed these conclusions as weak correlations were obtained between the promotion of independence and control, but strong negative correlations were found between the promotion of volitional functioning and control (Soenens et al., 2007; Silk et al., 2003). However, Lorenz and Wild (2007) suggested that autonomy-support in terms of volitional functioning may be more than the absence of pressure and control. In their study, these two dimensions were related to different aspects of student motivation and learning behaviours. Additionally, these relations lasted over a year or even partly for three years in their longitudinal study. Thus, they proposed that several mechanisms were involved in this parental influence on student motivation as opposed to volitional functioning and control strictly operating as two ends of one spectrum.

3. Structure

Structure is parents' conveyance of the relations between child behaviors and outcomes through the consistent provision of clear unambiguous expectations, guidelines and constraints (Grolnick & Ryan, 1989). It is the parents' organization of children's environment to facilitate children's competence; using provisions to monitor and evaluate children's behaviors and to follow through with the necessary consequences for misdemeanors. Apart from targeting behaviors, structure can also be targeted at children's thoughts and feelings for the internalization of key values (Grolnick & Pomerantz, 2009). A structured environment is supposed to facilitate the development of self-regulation and self-control (Barber, 1996; Soenens, Vanstennkiste, Luyckx & Goossens, 2006). In contrast, a chaotic environment undermines children's competence by lack of support (Skinner, Johnson & Snyder, 2005).

As previously mentioned, structure has often been compared to behavioral control. However, while most studies on behavioral control rely more on parental monitoring and limit setting, structure refers more broadly to the imposition of clear, consistent and developmentally appropriate structure on children's behaviors (Joussemet, Landry & Koestner, 2008). Structure is inherent in behavioral control but it does not involve pressure, intrusiveness and coercion (Grolnick & Pomerantz, 2009). Lorenz and Wild (2007) likens it more to Baumrind's (1991) concept of supportive control. In its relations to autonomy-support and control, Grolnick (2003) suggests that structure is orthogonal to these dimensions. Structure deals primarily with "what" parents do to monitor and regulate their children's behavior, but controlling versus autonomy-supportive parenting pertains to "how" parents implement this structure (cf. Soenens & Vansteenkiste, 2010). The effect of structure depends on the climate: "language that pressures children and close surveillance to ensure compliance make the structure controlling, but simply conveying information in a reasoned and empathetic way allows the structure to provide guidance while at the same time supporting autonomy" (Grolnick, Deci & Ryan, 1997, p.148). Therefore, the style in which parental guidelines are put across and behavioral monitoring is done has huge impact on the motivational dynamics of children. An autonomy-supportive parenting style increases self-determined forms of motivation, while a controlling style leads to maladjusted forms of motivation (Grolnick, 2003).

Grolnick & Ryan (1989) found that parental provision of structure was most highly correlated with children's control understanding in school and in general. Home environments, which have clear and consistent expectations and rules, facilitate children's differentiation of control processes. Structured environments, coupled with autonomy-support, have been found to facilitate internalization of external regulations. When faced with highly boring tasks, participants who were placed in more facilitative conditions demonstrated more self-determined behavior after the tasks; spending more subsequent free time on these tasks and having the experience of more positive feelings (Deci, Eghrari, Patrick & Leone, 1994).

A low degree of structure in home environments can make it difficult for children to develop optimally and securely as they are unsure of parental expectations and rules, and thus they lack guidance and awareness towards what the connections between certain actions and outcomes are. Structure equips children with "a sense of predictability and with a sense of personal efficacy to meet challenges and to competently execute instrumental actions" (Soenens & Vansteenkiste, 2010, p.79). With a moderate degree of structure, children are more able to understand the consequences of their actions and better direct their efforts to more beneficial activities and attitudes.

4. Involvement

Lastly, involvement is the dedication of time, attention and resources to the child (Grolnick & Ryan, 1989; Joussemet, Landry & Koestner, 2008). This includes activities that maintain interpersonal connection, such as practical and emotional support and nurturance. Highly involved parents put more effort to spend time with their children and invest more resources to maintain their connection to their children's daily lives.

Parental involvement has been less explored but some studies have demonstrated the importance of a secure relational support network in the flourishing of intrinsic motivation and facilitation of internalization, which in turn is associated with higher competencies and better control understandings (Grolnick, Deci & Ryan, 1997). When parents are actively involved and highly responsive to their children's needs, secure parent-child attachments are formed and these children display higher exploratory and mastery orientations as compared to their peers (Frodi, Bridges & Grolnick, 1985). Congruent with attachment theory research, these results confirm the significance of contingent and warm parental provisions to their infants. Children who are secure are

more likely to respond positively to parental requests in subsequent years with less aggression and less opposition to requests, thus suggesting greater internalization (Grolnick, Deci & Ryan, 1997). Maternal involvement has been shown to indirectly predict school performance of young adolescents through mediated pathways of perceived competence and control understanding, while paternal involvement influences school performance through perceived competence (Grolnick and Slowiaczek, 1994). Parental responsiveness has also been found to predict more autonomous forms of motivation in children, which in turn are associated with a better quality of learning and performance (Lorenz & Wild, 2007).

Looking at the broader picture, a combination of parental provisions of autonomy-support, structure and involvement, coupled with low psychological control, has been perceived as highly beneficial for children's growth and development. Grolnick and Ryan (1989) conducted parent interview studies to examine how these four dimensions were related to children's adjustment and competence in school- and home-related tasks. The outcome measures consisted of children's school outcomes which included children's self-ratings on self-regulation, competence and control at school, teachers' ratings of children's social and academic achievement, and child's academic achievement based on standardized tests and classroom grades. Higher autonomy-support from parents was found to be associated with more autonomous self-regulation, teacher-rated competence and adjustment, and higher academic scores. When parents valued autonomy and self-initiation, used reasoning and provided choices, children were more able to self-regulate autonomously and scored better on competence and adjustment measures. In contrast, when parents used controlling methods to impose their own agenda and gain compliance, children scored lower. There was a positive relation of structure with children's control of success and failure in school and in general. When parental rules and expectations were articulated clearly and consistently, children were empowered with a greater sense of control. Lastly, higher parental involvement had a positive relation to teacher-rated competence and adjustment, and to school outcomes. When parents were interested in and were actively involved in children's lives, children demonstrated higher competence and adjustment and had higher school grades and achievements. In the school domain, Lorenz and Wild (2007) and Exeler and Wild (2003) confirmed these findings and found that this combination of emotionally involved, autonomy-supportive and consistently structured parenting behaviors led to

higher forms of autonomous motivation while achievement-oriented and controlling parental instructional strategies proved detrimental for self-determined forms of learning motivation.

In conclusion, SDT postulates that an environment characterized by autonomy-support, structure and involvement can help to greatly facilitate children's internalization process and foster greater competence, healthier adaptation and overall well-being. Children require autonomy-support to learn through social interactions that they are capable, effective and agentic individuals with their own sense of personal identity. Structure is needed for the child to recognize expectations and rules which must be adhered to in order to become a competent member of society. Involvement fosters a more open child disposition which is more receptive of parental socialization efforts. In contrast, psychological control has been found to be detrimental to child development; undermining children's autonomy and associated with more problem behaviors. These findings in parenting research in SDT mainly complement the wider parenting literature, and reinforce the findings of Baumrind's (1971) authoritative parenting style.

2.4 Concluding Remarks

This chapter has sought to highlight the vital role parents play in fostering children's competence in a wide variety of domains, in supporting their children's intrinsic motivation and internalization processes, and in this process of socialization promote their children's well-being and flourishing in the long run. Competent parenting has been studied in Baumrind's (1971) typological manner of authoritative parenting – a complex of parenting characteristics defined by the balance of high involvement and high demands with clear communication about what parents require of the child and the use of non-controlling intrusive disciplinary methods – and in the dimensional approach of the SDT namely made up of three positive parenting dimensions – autonomy-support, involvement and structure – and one which undermines positive child outcomes – intrusive psychological control. The exercise of competent parenting practices are expected to have long-term consequences for the psychological and relational functioning of children.

Up till now, parenting dimensions have been scarcely investigated in relation to children's thinking skills of informal reasoning and beliefs of personal epistemology,

although past literature has shown that children's development of cognitive functioning is associated with parenting and achievement (Burleson, Delia & Applegate, 1992). Thus, the focus of this dissertation is to investigate the role of parents in the fostering of these two specific child outcomes. Empirical literature has demonstrated a positive association between reasoning and epistemological beliefs, with higher reasoning skills evidencing a more sophisticated and critical personal epistemology. The next two chapters will further elaborate on these constructs, their definitions and the relevant theoretical and empirical literature.

CHAPTER 3
INFORMAL REASONING

3.1 Conceptualization of Informal Reasoning

Reasoning is a broad cognitive process which can be defined as "mental activity that consists of transforming given information in order to reach conclusions" (Galotti, 1989, p.335). It underlies many processes in everyday cognition such as planning, decision-making and problem-solving. The psychology of reasoning has often been placed into two domains – formal and informal reasoning (cf. Evans, 2002; Evans & Thompson, 2004).

Formal reasoning is the assessment of logical competencies and was the main focus of the field for many decades, making significant theoretical and empirical contributions to our understanding of human nature. Being deductive in nature, formal reasoning can be completely divorced from external reality. Studies in this domain often centre on deductive reasoning paradigms, in which people are asked to assess logical arguments or to generate valid conclusions from given premises (Evans, 2002). Some examples of deductive paradigms are classical syllogisms or statistical inference (Evans & Thompson, 2004).

In recent years, the restrictiveness of formal reasoning has been highlighted, and questions arose regarding the extent that formal reasoning research can actually inform us about the reasoning people typically engage in during everyday lives (Evans & Thompson, 2004; Galotti, 1989). The reductionist strategy of decomposing complex behavior into smaller units and analyzing how these individual units function in highly controlled tasks has not been effective for cognitive psychologists as even simpler cognitive processes like categorization has made it evident that reasoning does not occur in an isolated manner but instead, is embedded in a broader set of ideas and theories (cf. Kuhn, 1991). Studies on reasoning thus began to venture towards investigating reasoning in everyday situations, with a greater interest in the use of realistic ill-structured problem materials as opposed to structured settings with abstract problem materials (Evans, 2002). In everyday reasoning, individuals draw conclusions with varying degrees of confidence as fixed premises often do not exist.

In the hope of clearly defining informal reasoning, the contrast between formal and informal reasoning will be highlighted to aid this understanding. Formal reasoning concerns first, a well-structured problem with explicit background premises to solve the problem; and second, the endpoint of only one correct solution to the given problem (cf. Evans & Thompson, 2004; Evans, 2002). It is usually evoked when problems are familiar and compatible with existing knowledge. The well-structured problem "can be solved by use of the information provided and no other; in fact, the correct solution to these problems often requires the reasoned to use only the information provided in the premises, and to avoid adding background information and knowledge to the problem domain" (Evans & Thompson, 2004, p.69). Explicitly stated premises generally contain all the information that the individual should take into account and consider when reasoning in order to arrive at the solution. The single correct answer or conclusion is often deduced with a standard, agreed-upon method of reasoning. For example, experts solving physics or mathematics problems have typically achieved advanced formal reasoning competence as they often rely on a similar store of patterned schemata in order to find the correct solution to a problem.

In contrast, informal reasoning concerns first, an ill-structured problem with less dependence on given premises but more on individual's background knowledge and experience; and second, the possibility of having more than one solution to the problem. Everyday tasks are contextualized in uncertain changing environments, characterized by shifting, ill-defined or competing goals or by missing and uncertain information (Evans & Thompson, 2004). These decisions can involve time stress, high stakes and multiple participants (Woll, 2002). Premises are not clearly defined and can change with additional information (Perkins, Farady & Bushey, 1991). Successful informal reasoning requires people to go beyond what they are told, by searching memory or consulting outside resources to find relevant information (Galotti, 1989). It is more dependent on the individual's background knowledge and experience, as a greater depth and breadth of stored knowledge helps to sort through the catalogs of knowledge and determine exactly what pieces of knowledge are relevant to the solution (Simon, 1973). Informal reasoning requires more of the individual to consider the causes and consequences, pros and cons of particular propositions or various decision alternatives in order to reach a conclusion (Zohar, & Nemet, 2002). Furthermore, ill-structured problems often have more than one right solution. These problems may also not be solved via one single, consensual 'form'

or method, and its resulting conclusion, unlike that of formal reasoning which is clear and unambiguous, often (but not always) is not (Evans & Thompson, 2004).

Additionally, informal reasoning problems typically bear some personal relevance and occur as part of a larger context, whereas those involving formal reasoning can be separate from external reality and be self-contained (Evans & Thompson, 2004). When problem material has personal links, changes in the reasoning process may result (Evans, 1989). Emotions can enhance or diminish reasoning skills and this holds especially true for highly-charged topics such as political reasoning or publicly debated socioscientific dilemmas (e.g. cloning). Personal goals can also affect the reasoning process when there are multiple players involved and the desire to maintain a relationship overrides the goal of finding the best solution to the problem (cf. Stein & Albro, 2001). Formal arguments are regulated by the intellectual goal of validating the truth value and logic of evidence, whereas everyday arguments are regulated by interpersonal goals. Informal problems are often solved as a means of achieving other goals but formal problems often are engaged for their own sake.

Table 3-1. Main features of formal and informal reasoning

CONTRASTING FORMAL AND INFORMAL REASONING	
Formal	**Informal**
1. Well-structured problems 2. Given premises must be considered to solve problem; answer is a function of domain-specific knowledge and expertise 3. Usually has one established method to get to one definite correct solution 4. Self-contained and engaged for its own sake	1. Ill-structured problems 2. Individual ability to generate or retrieve the relevant premises based on stored background knowledge and experience, rather than given premises 3. Possible to have more than one solution and more than one method of arriving at solutions 4. Personally relevant and occurs as part of a larger context

Defining "Informal Reasoning"

Although the broad defining characteristics of informal reasoning are outlined above, an exact succinct definition of it is elusive and the ways of measuring it, tricky (Galotti, 1989). Means & Voss (1996) argued that despite its fuzzy nature, argument skills remain at the core of informal reasoning. Argumentation has been recognized as a broader general human process under which more specific forms of reasoning can be

found (Oaksford, Chater & Hahn, 2008; Goldstein, Crowell & Kuhn, 2009). Reasoning skills are applied through the assertion, support and refutation of claims and conclusions (Kuhn, 1991; Means & Voss, 1996; Zohar & Nemet, 2002). Sadler (2004) noted that "research from a variety of disciplines supports the notion that studying argumentation serves as an effective means of accessing an individual's informal reasoning (p. 516)". Thus in my dissertation, informal reasoning is defined similarly to that of Means and Voss (1996) and Kuhn (1991, 2005): "a goal-dependent process that involves generating or evaluating (or both) evidence pertaining to a claim or conclusion... *which* assumes importance when information is less accessible, or when problems are more open-ended, debatable, complex or ill-structured, and especially when the issue requires that the individual builds an argument to support a claim" (Means & Voss, 1996, p.140)". The process of searching, evaluating and selecting relevant information is intertwined inextricably with the problem one is faced with. The individual has to evaluate different alternatives and positions in order to reach a final decision, which can be complex, multifaceted, and unique to the construction of the argument. The terms of 'informal reasoning' and 'everyday reasoning' may be used interchangeably in this work as both represents the same form of reasoning explored in this study.

3.2 Children and Adolescents as Reasoners

In the past, most work on reasoning had been done on older participants from adolescence onwards as it was presumed that young children were unable to produce sophisticated thinking strategies due to their tender age. However, later empirical work proved otherwise (cf. Stein & Albro, 2001; Stein & Miller, 1991). Literature on scientific reasoning (Zimmerman, 2000, 2007) has now made it evident that children are far more competent than first suspected. Metz (2004) suggested that failures of previous research could be due to researchers not being demanding enough and not providing particular scaffolds needed to enable the successful participation of children in authentic inquiry.

Relatively young children have been found to demonstrate some competence in producing arguments in support of a claim (Stein & Miller, 1993) and in understanding the structure of an argument (Chambliss & Murphy, 2002). Children of three to four years have rarely allowed disputes to end with a simple refusal of being told 'no', but are more likely to end a dispute with a justification or a mutually acceptable alternative

proposition (Eisenberg and Garvey, 1981). Despite children's justifications not being always convincing or compelling to adults, the point that they do provide justifications represents an understanding of its role in argumentation. Furthermore, Orsolini (1993) found that in certain contexts where young children have experience and the understanding of the expectation and value of justifications, they can produce them without prompts. Using recorded hours of spontaneous arguments between children, Orsolini found three contexts in which this often happened: (1) when children described negative events, (2) when children made negative assertions, and (3) when children had a high commitment of truth to what they were saying. Throughout, children demonstrated a clear capacity for producing justifications of their ideas, assertions and observations. On further investigation, Orsolini found that teachers often prompted justifications with 'why' questions across these three contexts, thus suggesting that children may be made aware of the notion of justifications through the experience of discourse with adults.

Amsterlaw (2006) demonstrated that children as young as first graders (6-7 years) showed some capability to distinguish between everyday situations which involved reasoning from those which did not. Reasoning cases were distinguished by the use of more thinking, mental effort and logic, more strategies, clearer goals, and less automatic responding. Non-reasoning cases, in contrast, used shortcut problem solving (e.g., flipping a coin to decide) or were responses using automatic reflex instincts (e.g., removing hand from hot stove). First-graders were able to distinguish reasoning cases successfully from shortcut problem solving, but had more problems with distinguishing reasoning from automatic cases. They indicated similar high amounts of deliberate, effortful thinking for automatic as well as for reasoning cases. However, by third grade (8-9 years), automatic cases were correctly classified as utilizing little mental effort and by fifth-grade (10-11 years), there was an emergence of an adult-like, process-focused concept of thinking quality in which children seemed aware of important process features that underlay problem solving, such as the degree of mental effort and length of time needed for a problem, and used these features to distinguish between various thinking strategies.

Amsterlaw (2006) further investigated if children had the ability to distinguish good from bad reasoning processes with the use of two conditions: the first condition tested if children were sensitive to basic quality distinctions in the thinking process by providing scenarios which included only information about the thinking process and

none about outcome, while the second condition tested the belief if the characteristics of the thinking process were more important to assess good/bad reasoning despite the outcome which was inconsistent with process quality (i.e., good thinking with bad outcome or bad thinking with good outcome). Participants were asked to rate each given scenario on the exercise of good or bad thinking and to provide explanations for these ratings. Explanations were coded into process- or outcome- based, or mixed. The response patterns of first-graders, third-graders, fifth-graders and adults revealed similar trends, with higher percentages of older participants providing correct answers to the scenarios given. The tendency to explain thinking quality ratings by referencing thinking process features increased with age, particularly for children between first and third grade. Adults rated good-process with bad-outcome scenarios higher than bad-process with good-outcome scenarios but in contrast, first graders' dominant response rated bad-process with good-outcome scenarios as higher. Although adults evaluated thinking quality as a function of underlying thinking processes even when outcomes were mismatched, first-graders in contrast tended to privilege outcomes over processes. However, children appeared to weigh process and outcomes equally by third grade. Amsterlaw (2006) postulated that when outcomes were inconsistent with process quality, older children and adults might have discounted them as due to factors beyond the actor's control while younger children held actors equally accountable for both strategy choices and outcomes.

Overall, Amsterlaw (2006) demonstrated that even first graders have some basic intuitions about the difference between good and bad thinking. By third grade, they have the ability to successfully differentiate between cases which need reasoning from those which do not as their concepts of thinking quality become increasingly process-based as opposed to outcome-based explanations. "Children's responses to reasoning assessments in everyday contexts suggest that children readily recognize the legitimate problems these situations present, are interested in questions about the status of various problem-solving approaches, and have an emerging set of important insights about these issues" (Amsterlaw, 2006, p.459). However, this relationship is not always straightforward as children's reasoning does not always improve with age (cf. Jacobs & Klacynski, 2002) and knowledge of appropriate strategies and standards considered necessary for effective reasoning is also not always sufficient, such as when adults fail to live up to standards of normative judgments.

Although children have been shown to be capable of understanding reasoning and argumentation, they still have much to learn with regards to being able to argue well (c.f. Kuhn, 2005). When evaluating argument skills with fixed premises in the context of everyday life, children and adolescents and sometimes even adults struggle to differentiate and coordinate theory and evidence, often bending them to fit prior beliefs. Kuhn and Pearsall (2000) demonstrated this failure to distinguish between evidence and theoretical explanations as basis for simple knowledge claims in a sample of four to six-year-olds children. An example consists of children being shown a sequence of pictures in which two runners compete in a race. A cue in the pictures suggests a theoretical explanation concerning why one might win – one runner has fancy running shoes, the other does not. The final picture in the sequence provides evidence of the outcome - one runner holds a trophy and exhibits a wide grin. When children were asked to indicate the outcome and to justify this knowledge, four-year-olds showed a fragile distinction between the evidence for their claim (the outcome cue in the case) versus their explanation as to why it is plausible (the theory-generating cue). Rather, the two merged into a single representation of what happened. Thus, in the race example, young children often answered the "how do you know (he won)?" question not with evidence ("he's holding the trophy") but with a theory of why this state of affairs made sense ("because he has fast sneakers"). These confusions between theory and evidence diminished sharply among six-year-olds, who still made mistakes but who usually distinguished the evidence for their event claim from a theoretical explanation that made the claim plausible.

A monotonic developmental trend regarding the differentiation and coordination of evidence and theory was found from middle childhood (grades 3 to 6) to adolescence (grade 9) to adulthood (Kuhn, 1989). Adults were most successful in differentiating these concepts although some adults still tended to meld theory and evidence into a single representation, thus suggesting that these skills may not necessarily be well developed by adulthood. Kuhn, Amsel and O'Loughlin's (1988) series of studies also found that participants tended to use a variety of strategies to keep discrepant theory and evidence aligned. These strategies include ignoring or distorting certain evidence, or selectively attending to evidence that was consistent with their beliefs or theory. Additionally, participants tended to adjust theory to fit evidence. When evidence did not match their beliefs, participants would modify their theories to fit the evidence. An example was a

ninth grader who had a theory that the type of condiment (mustard vs ketchup) was not causally related to catching colds. When faced with cumulative covariation data evidence, he had to acknowledge the data but made sense of this evidence by elaborating on his theory with regards to the amount of ingredients or vitamins and the temperature of the food the condiment was served with.

Kuhn et al's (1988) studies have been criticized regarding the presence of confounding variables such as the task complexity and strength of prior beliefs in children (Zimmerman, 2007). Although Kuhn and her colleagues used naturalistic settings as a method of evoking reasoning, the focus in their studies was more on deductive reasoning; with conclusions drawn from given data evidence without reliance on prior beliefs. However, problems reflective of everyday reasoning are often complex. Prior beliefs do play a role in the navigation of the problem premises and they affect the filtering and selection of background knowledge in order to reach a reasonable conclusion.

Alike to Kuhn and colleagues, Means and Voss (1996) used everyday contexts to assess reasoning of children, but unlike Kuhn, they did not give premises and data for reasoning but used open-ended ill-structured problems to generate arguments and justifications from participants. They investigated the relations of ability level (gifted, average or below average) as defined by standardized tests of intelligence, grade level (fifth, seventh, ninth and eleventh) and knowledge level with informal reasoning performance. Three tasks were given to each participant: 1) an ill-structured problem task where open-ended everyday problems with debatable solutions (e.g., "If students misbehave in school, what should be done?") were presented and participants' skills in argument generation were assessed, 2) a problem solution assessment task where four responses were given to the problem scenarios and participants had to rank them by quality and to provide explanations, and (3) a problem difficulty assessment task where problem sets, each consisting of three problems along a well-structured to ill-structured continuum, were presented and participants had to judge in what circumstances informal reasoning had to be applied and to justify their answers. Participants' responses were analyzed in terms of components of an argument, such as the number of sound arguments and counterarguments, the correctness of their rank orders and the justifications provided for the orders being acceptable or vague. Results showed that ability had the strongest significant effect in differentiating reasoning performance: participants of high ability

performed well in all three tasks and evidence more developed and elaborated argument structure with a higher proportion of high quality reasons. Grade level, however, only had a weak significant relation. Overall, reasoning improved across increasing grades and ability levels.

Means and Voss (1996) further investigated if topic knowledge could be a confounding factor as it could be argued that higher-ability students had more knowledge about the topics. On the topic of drug and alcohol, Means and Voss measured participant's knowledge of domain along with ability and grade levels. Participants were first given four controversial propositions (e.g. "The use of marijuana should be legalized") and asked to rate their opinion on a ten-point scale along with explanations. Next, the same set of propositions were given, but each proposition was paired with two reasons and participants were asked to rate how strongly each reason supported the proposition on a ten-point scale and to justify differences in ratings of reasons. Participants' responses were coded into components of an argument and analyzed. The results showed that knowledge was significantly related to generation of more reasons, but it was not related to the number of sound arguments or the generation of high-quality reasons when ability level was factored in. Vague low quality reasons were found to be significantly related to ability level but not knowledge. Thus, this supports the first study's conclusion that ability level, not knowledge, best explains high quality reasoning performance. Reasoning performance as a function of the interaction of ability level and grade was also not significant, thus demonstrating that ability level differences are critical for informal reasoning regardless of grade level. This notion is confirmed by the results that high-ability fifth-graders sometimes performed better than eleventh-graders.

Additional to the mere inclusion of everyday contexts for reasoning studies, controversial issues of a social moral nature (e.g. teenage pregnancy or capital punishment) or a socio-scientific nature (i.e. with conceptual or technological links to science; e.g. genetic cloning) are increasingly being utilized as reasoning problems for children from middle grades to adolescents in high school. These ill-structured problems are often in national spotlights, have unclear boundaries, and no 'right' solution. The use of these complex issues has been argued to equip students with skills to effectively handle contentious issues that shape their current world and those which will determine their future world (Sadler, 2004). Educators are increasingly aware of the critical significance of classroom curriculums being more reflective of and relevant to current

debates of society, in contrast to it being an isolated, irrelevant academic discipline (Kuhn, 2005).

Kortland (1996) found that middle-schoolers (aged 13-14 years) possessed the ability to structure a basic argument, but these arguments were of limited range, clarity and application with regards to environmental issues related to waste management and recycling. Alike to Kuhn's (1989) finding that individuals tended to employ strategies to support their theories, participants limited their arguments to include only factors which provided direct support for their stated position, with no counterarguments or rebuttals offered. In the context of genetic and environmental variability of farm-raised chickens, Jime´nez-Aleixandre, Rodriguez and Duschl (2000) also demonstrated the limited nature of ninth-graders' argumentation skills. Small-group discussions between participants were analyzed with the task of advising biologists studying fictional chickens which have deviant feather types (yellow coloured instead of spotted) and to suggest causes for this variability with reasons and justifications. Analyses of these discussions showed that most of the argumentative statements made were claims backed up with some warrants but most argumentation focused on causality and appeals to analogies, and participants appeared far less concerned with issues of consistency and plausibility. In one particular group which the report focused on, no qualifiers or rebuttals were made. This particular group of ninth-graders appeared to lack the skills of argumentation to contribute to the discussion.

Adolescents have also been found with the tendency to engage in shallow analyses of information (Kolstø, 2001). Interviews were conducted on the issue of whether the presence of power transmission lines increased risk of childhood leukaemia. After analysing the ways in which adolescents evaluate knowledge and knowledge claims as they prepare for socioscientific decision making, Kolstø found that participants' responses could be interpreted in a two-factor matrix. First, they based their judgment on either the information statements or the authorities who gave the information. Second, they displayed two general modes of judgment: acceptance or active evaluation. Therefore, participants accepted or evaluated the informational statements, or they accepted or evaluated the source of knowledge. A group of participants accepted knowledge claims at face value while another group subjected them to evaluation by describing ways to test reliability of information by seeking independent support for the statements. When it came to source of knowledge, information was

accepted based on two general criteria: they conveyed confidence in their research or they are perceived as experts in that specific area. A final group of participants was willing to judge the validity of information on its source, but would not accept the authority without an evaluative process. This evaluative process consisted of one of four standards: assessment of risk, interest, neutrality or competence. Assessment of risk refers to the authority figure's discussion of risk associated with the decision to be made; the more they talked about potential risk, the more credibility they were given. Interest refers to sources with vested interest versus uninvolved, neutral sources; some participants ascribed more validity to sources with vested interest while others preferred neutral sources. Competence refers to the seeking of independent support of the authority figure's competence. Although some evaluative strategies were employed by most participants to assess given information, the conclusions reached were partially based on empirical evidence but most were based on rather superficial contextual information. The conclusions were often short sighted or inaccurate, revealing the shallowness of the analyses conducted.

Adolescents also revealed a lack of capability in strategic and flexible behaviour with respect to goals of dialogic argumentative discourse (Felton & Kuhn, 2001). On the topic of capital punishment in three samples of seventh-graders, eighth-graders and young adults, participants were placed into agreeing, disagreeing or neutral dyads based on their positions on capital punishment identified through an opinion scale. Agreeing dyads had the same position on capital punishment, disagreeing had opposite positions, while neutral dyads had somewhere in between. Over the course of five dialogues conducted with different partners, every participant was assigned to at least one of each dyad. Dyad members in agreement were asked to identify all the reasons which supported their stand while those in disagreement were asked to try to find a consensus. Their dialogues were coded into categories which reflected different dialogic elements that formed argumentation (e.g., clarification, advancing, countering). Analyses of these dialogues revealed that seventh- and eighth-graders were less capable in the use of counterarguments and rebuttals, were less able to direct and define partner's argument with the intent to weaken it, and showed less adaptation of strategies to the changing requirements of discourse contexts, such as when they are moved from disagreeing to agreeing partners. Overall, they tended to be more preoccupied with producing dialogue and behaved less strategically and flexibly to the goals of argumentative discourse.

Thus to conclude shortly, children and adolescents are often able to form basic arguments, but their arguments are often limited and non-critical, especially in the provision of counterarguments and rebuttals (Kortland, 1996; Jime´nez -Aleixandre, Rodriguez and Duschl, 2000). Kolstø (2001) elaborated that adolescents engaged in shallow analyses of information and did not frequently engage in the kind of comprehensive reflection and evaluation needed to assess the usefulness of information in complex issues. Felton & Kuhn (2001) added that in dialogic argumentation performed in dyads, adolescents were less strategic, less flexible, less consistent and less able to direct and define the argument as compared to young adults. Therefore, although the present literature demonstrates that children and adolescents are capable of argumentative reasoning, their ability to argue well is limited and needs to be supported and enhanced. This leads on to the next section of how informal reasoning develops and the conditions which bring about change and development.

3.3 Development of Informal Argumentative Reasoning

Moshman (1994) suggested two likely mechanisms that led to developmental change in children's reasoning: (1) children's introspective reflection about their reasoning experiences and (2) social learning in interaction with adults. Reflection increases one's metacognitive awareness, making one aware of effective strategies for higher reasoning. Moshman (1994) suggested that the encouragement of reflection is facilitated with the fostering of appropriate self-concepts, attitudes and intentions, including philosophical concepts of seeking for truth and clarity and inculcating a "critical spirit". Genuine reflection encompasses the enablement of social settings for the questioning of deeply ingrained and accepted ideas even if they may seem disconcerting for others involved. The true flourishing of reasoning occurs in an environment where education is fully committed to promoting active thinking, questioning, exploring diverse sources of information and openly expressing one's own ideas, coupled with the allowance and encouragement to critique deeply ingrained assumptions and ideas.

In line with Vygotskian theory of cognitive development, the value of external social collaboration is emphasized in promoting more advanced forms of individual reasoning. Joint participation in an activity permits cognitive processes to be displayed, shared and practiced. Day, French and Hall (1985) elaborated on the significance of the

social world in cognitive growth through four points: a) cognitive abilities are socially transmitted from experts to children, b) cognitive abilities are socially constrained, that is, certain cognitive skills can only be employed in social interactions and not in isolated working, c) cognitive abilities are socially nurtured as experts can help assume responsibility for some aspects of the activity while the child can concentrate on one component, thus reducing cognitive workload and facilitating successful mastery, and lastly d) cognitive abilities are socially encouraged for independent use as experts reduce responsibility held in activity when child demonstrates increasing competence. Children's earliest forays into problem-solving and decision-making often occur in social collaboration with more expert individuals, such as with parents and teachers. Social contexts provide children with the opportunities to acquire and share knowledge, to display competencies, and to learn and practice new skills. Through direct (e.g. instructional) and indirect (e.g. modelling, practices, feedback) teaching, children acquire the specific knowledge and skills needed for successful reasoning. Parents and teachers hold significant roles in providing the necessary structure and support to scaffold learning and to help children to refine their skills.

Empirical studies have provided support for the two above-mentioned points – reflection and social learning. However, compared to classroom-based studies which have recently spawned many empirical works investigating the development of reasoning and formulating interventions for improved argumentation, family-based studies investigating the specific development of argumentative reasoning in everyday contexts are sparse in psychology.

Empirical studies on family conflict talk have been one method of glimpsing argumentation at home. Participation in family conflict interchanges and acquiring conflict resolution strategies help children to gradually learn mutual regard and understanding for others, influencing children's reasoning and thinking skills and subsequently, their strategies when participating in constructive and effective social interchanges (cf. Stein & Albro, 2001). Findings show that through observations from a young age, children learn how to raise opposition to dominant, older members of the family. As their linguistic competence and cognitive skills improve, coupled with an increasing social knowledge about rules and rights, they become more successful at negotiating (Ross, Filyer, Lollis, Perlman & Martin, 1994; Telsa & Dunn, 1992). They may even prevail at times in disputes with parents or older siblings (Eisenberg, 1992).

However, family conflict often involves relational goals which can cause children and adolescents to use less complex reasoning in family negotiations (cf. Stein & Albro, 2001). Children are sensitive to changing contexts of arguing, and with the nature of the relationship at stake, at times they may appear to be irrational and incapable of complex and language skills in one situation but highly rational in another. The nature of their social relationships as well as their feelings for each family member are reflected in and affected by the types of interactions children have with each family member. Vuchinich, Vuchinich and Coughlin (1992) showed that adolescents who participated in negotiations with their parents used less complex reasoning in the throes of an ongoing argument as compared to their recall and evaluation of an earlier argument. The decline in skill expression during face-to-face conflicts is due partially to the fact that different goals operate in face-to-face interactions than in individual interviews. During an interaction, old arguments may be rekindled, causing two arguers to engage in an intense emotional exchange rather than in a logical discussion about the pros and cons of each position. The missing logic during face-to-face interaction is often expressed in an elaborated fashion during individual interviews.

Additional to conflict talk, reasoning skills may also be improved through casual family talk during leisure moments. Ladd, Profilet & Hart (1992) found that parents often engaged children in 'decontextualized discussions' that could occur during dinner, after school, before bedtime or during travel. These discussions helped to prepare children to face future social dilemmas (note: often involving informal reasoning) such as discussions on how to dissuade a bully, or to provide a sounding board for children's self-generated solutions such as on solutions to mend a friendship. Parental engagement reflecting authoritative connection and autonomy-supportive features has been positively associated with increased socio-communicative competence in children. Such engagement may include frequent conversations in which there is reciprocity in turn taking, the high quality of advice that is relevant to resolving a peer issue, good listening skills and warmth (Profilet & Ladd, 1996 in Hart, Newell & Olsen, 2003).

Families have also been found to be characterized by their communication patterns (Koerner & Fitzpatrick, 2002). Family communication orientations, namely conversation-orientation (i.e., the degree of unrestrained open family interaction about a wide range of topics) and conformity-orientation (i.e., the degree of homogeneity of attitudes, values and beliefs in the family), have been shown to influence reasoning

strategies and cognitive development (Fitzpatrick & Ritchie, 1994; Koerner & Fitzpatrick, 2002). Children of families high in conversation-orientation are more influenced by the quality of an argument (i.e., structure and quality of supporting evidence), whereas children of families high in conformity-orientation are more influenced by the social status of the message source (Fitzpatrick & Ritchie, 1994). This shows that when families have a communication climate that encourages their children to participate openly in frequent discussions over different topics, children acquire higher level reasoning skills and learn to differentiate good arguments from poor ones by evaluating the argument content, structure and given evidence. However, when families enforce a conforming communication climate emphasizing interdependency and conflict avoidance, children are more influenced by the source of argument rather than the content of the argument itself. Furthermore, children of families high in conversation-orientation demonstrate better developed communicative and problem-solving skills, thus allowing them to better negotiate their roles and expectations with others and be more resilient in difficult environments (Fitzpatrick & Koerner, 1996). Contrastingly, families high in conformity-orientation perform less well in both social and problem-solving skills, being unable to be flexible to changing situations and unable to solicit help and existence from the social environment. Conformity-orientation has also been shown to have a negative association with empathy and perspective taking (Koerner, 1995). In studying conflict interactions (Koerner and Fitzpatrick, 1997), conformity-orientation was positively correlated with conflict avoidance and the venting of negative feelings, perhaps due to the pressure to avoid violating family norms which dictate against engaging in conflict and the growing hostility and resentment stemming from previous unresolved conflicts. In contrast, conversation-orientation was negatively correlated with conflict avoidance and positively correlated with seeking social support. Thus, conversation-orientation may support children to acquire better conflict communication skills and more tools to mitigate the negative consequences of interpersonal conflict.

Apart from the few family studies around, some classroom-based intervention studies can be complementary in illustrating the effectiveness of social contexts and reflection in the development of reasoning. These studies have shown that extended engagement in reasoning tasks produces positive effects on thinking and argumentation, presumably because they learn from reflected task feedback. The importance of social context is highlighted in the use of dyadic dialogues for improving argumentation and the

effective presence of expert individuals, such as teachers, in making explicit explanations and reflections of argument structures. Felton (2004) suggests three possible means by which such dyadic practice can improve argumentative discourse: (1) participants adopt new critiques from their partners; (2) they generate new critiques themselves; or (3) they generate them with their peers in the course of dialogue.

Kuhn, Shaw and Felton (1997) demonstrated the effectiveness of dyadic interventions for improving argumentation skills with seventh-graders, eighth-graders and young adults. Dyadic dialogues with conditions similar to that described in Felton and Kuhn (2001) in Section 3.2 were used: participants were placed into dyads with different partners who either had opinions congruent or discrepant from the participant's. Dyads were asked to discuss their opinions about capital punishment, and to try to reach a consensus over it. If that is not possible, they are asked to identify the nature of their disagreement. All dialogues were recorded, transcribed and coded with an analytic scheme in terms of the presence of various argument elements. In both adolescents and young adults, post-test results showed that sustained engagement of dyadic argumentation produced significant changes in both the range of arguments (i.e. no of arguments) exhibited and the quality of argumentation (i.e. more metacognitive statements, more two-sided arguments). However, adolescents demonstrated much less proficiency in arguing in a framework of alternatives while adults considered more of multiple alternatives with their accompanying evidence. Adolescents were less likely to report change in opinions compared to adults, even though more objective quantitative assessments of their arguments say otherwise. The latter assessment was done by classifying the change from pre-test to post-test assessment. Adolescents were found to be twice as likely as adults to have a quantitative opinion change while adults were more likely to have only small to moderate changes in position, such as the movement from a more to less extreme position without changing sides. The overall increase in argumentation exhibited in both age groups suggested a social transmission of new content through interaction with peers. Dialogic interventions targeting argumentation skills have also been found to be effective in other populations, such as in academically at-risk students (Kuhn & Udell, 2003) and severely disadvantaged juvenile delinquents (Kuhn & DeFuccio, 2002).

Likewise, Goldstein, Crowell & Kuhn (2009) showed that extended engagement in argumentation with partners of varying perspectives produced significant

improvements in sixth- and seventh-graders' ability to address opposing peer's arguments with cogent counterarguments. The year-long intervention conducted in a twice-weekly philosophy class provided dense experience in argumentative discourse as students debated on real-world social issues, first in interchanges with a succession of peers holding an opposing view and finally in a whole-class debate. At the end of the year, middle school students showed themselves capable of learning to produce higher-level counterarguments, though when presented with two counterarguments, students did not improve significantly in recognizing which was stronger with respect to power to weaken a claim. Nevertheless, extended practice with reasoning was shown to improve thinking and argumentation.

Felton (2004) later found that a combination of practice and structured reflection was more effective in promoting change than practice alone. Five weekly dialogues were conducted in groups of four consisting of two assigned dyads, with each dyad having partners with opposing views on the topic of capital punishment. In the experimental condition, participants engaged in a combination of dialogues and paired reflection on these dialogues. In the dialogues, participants were instructed to find out what they agreed and disagreed on about capital punishment and to come to an agreement if possible. When one dyad engaged in dialogic argumentation, the other dyad was asked to observe without interruption, and vice versa. After each dialogic session, participants underwent reflective exercises which consisted of reviewing with a like-minded peer the major arguments, counterarguments and rebuttals in the dialogue provided. Control group participants, however, only engaged in the dialogues without the reflective exercises. The dialogues were transcribed and coded according to Felton and Kuhn's (2001) analytic scheme for argumentative discourse; each utterance being coded into specific sequences of argumentation. Both groups showed improvements in argumentation after the intervention but the experimental group demonstrated greater advances in argumentative discourse than control participants, as evidenced by the higher use of more sophisticated strategies such as rebuttals and critiques of opponent's argument. Additionally, Felton (2004) found that experimental participants also performed better on a transfer topic of abortion, employing higher level argumentative strategies, thus suggesting that reflection may help one to understand the relative value of the strategy independent of the topic of argument. Thus, although practice alone can improve discourse, its effects may be limited to the topic practiced. Reflection enhances

development by focusing on the structure behind argumentative discourse in order to support a greater sensitivity to the function of strategies in argumentative discourse, and an awareness of the structure and goals of discourse in order for them to be used effectively. This leads to more advanced and generalizable strategies characteristic of adult argumentative discourse.

The transfer of argument skills has also been demonstrated by Zohar and Nemet (2002) to be possible from school to everyday domains. The explicit classroom teaching of argumentation in the specific domain of genetics proved to be useful for everyday moral dilemmas as adolescents learnt to apply the argumentative strategies acquired in class to their everyday life. After a twelve-weeks intervention teaching biological knowledge and argumentative strategies in the construction of arguments in genetics, results revealed that similar gains in the formulation of successful arguments, evidenced by an increased number of justifications and increased complexity of arguments, were seen in a post-test consisting of a moral dilemma in everyday life (i.e. cheating in a class test). Thus Zohar and Nemet argued that explicit teaching of argumentation not only advances skills in school-based topics, but also enhances performance in everyday domain-general argumentation.

However, although extended practice with argumentation coupled with reflective exercises have been shown to facilitate improvements in argument skills and to increase the likelihood for an effective transfer of these skills to other topics and to other domains, Udell (2007) demonstrated that the transfer of argument skills may be more successful from personal to less personal issues but not the other way round, that is, that reasoning skills learned from arguments on broad issues of low personal relevance has little success of being transferred over into personal matters. In an intervention study, adolescent girls aged fourteen to fifteen years old were divided into two groups, with one group dealing with the topic of capital punishment (less personal issue) and the other with unwanted teenage pregnancy (highly relevant issue). Participants who had the capital punishment topic for intervention had the other topic of teenage pregnancy as a transfer topic at post-test, and vice versa. Results showed that although both groups showed gains in argumentative skills after the intervention, only the group which received argumentative intervention on the highly personal topic of teenage pregnancy evidenced similar gains (e.g., higher use of counterarguments) in the less personal transfer topic of capital punishment. However, these results were not reflected in the group which received

intervention on the topic of capital punishment and given the transfer topic of teenage pregnancy. Udell (2007) suggested that emotional salience may be a possible factor that accounted for this one-directional result, as personal topics evoke higher emotional affect, thus participants have to practice emotion dysregulation which takes focus away from utilizing effective discourse strategies. This loss of focus causes the transfer of skills from less personal to more personal issues to be more challenging and therefore, requiring more effort.

Hence, although Zohar and Nemet's (2002) study suggested that argumentative skills taught in school can be successfully transferred to everyday dilemmas, Udell's (2007) results suggested that these skills may not be as successfully transferred from broad issues to personally relevant issues due to emotional affect. However, broad issues rather than personally salient issues are more often used as reasoning problems in the school context. Therefore as much as schools and teachers are essential for the shaping of children's reasoning skills in issues of high relevance to science and society, there is a need for children to have practicing opportunities for issues that may not be popular school material but hold high personal relevance in their everyday lives. The home environment comes to mind as an appropriate surround to discuss these issues. Parents need to recognize that the role of the home environment is as critical as the role of the school; that they are highly influential agents who can help foster their children's argumentative reasoning in issues external to the school domain, and in doing so, provide their children with a capability to effectively reason across a variety of topics in different settings.

To shortly conclude this section, the development of reasoning has been suggested to take place when introspective reflection occurs and when social learning in interactions with experts is experienced. Within the family, conflict talk has been shown to be vital for the child's cognitive growth and reasoning as children gradually learn ways to successfully negotiate with older family members and may even prevail at times in disputes with parents and older siblings (cf. Stein & Albro, 2001). However, relational goals can confound the use of logical and complex reasoning when social relationships as well as emotions for family affect the type of interaction and strategies one uses. Additional to conflict talk, casual family time can also act as useful learning points for parents to engage children in 'decontextualized discussions' to guide them in reasoning about social dilemmas faced in daily life, with authoritative practices of autonomy-

support positively associated with increased socio-communicative competence of the child (cf. Hart, Newell & Olsen, 2003). Family communication orientations (Koerner & Fitzpatrick, 2002) are also influential in shaping children's communication and reasoning skills. Conversation-orientation is associated with children being able to differentiate quality of argument from structure and supporting evidence, demonstrating better developed communicative and problem-solving skills and evidencing higher resiliency in difficult situations. In contrast, conformity-orientation leads to children demonstrating more shallow information processing (i.e., being more influenced by source of argument rather than the content of the argument itself), possessing less competent social and problem-solving skills and displaying more conflict avoidance and venting of negative feelings.

Classroom studies have also contributed to our understanding of essential elements helpful for the development of argumentative reasoning. Dyadic dialogic interventions have consistently led to improvements in argumentation, suggesting that participants learn from social debates where they pick up new arguments and critiques or in the process generate new ones themselves (Kuhn, Shaw and Felton,1997; Felton, 2004; Kuhn & Udell, 2003; Udell, 2007). These interventions help adolescents to advance in their development by reducing the use of ill-suited strategies and increasing those well-suited to argumentative discourse. Argumentative skills can be greatly advanced in collaborations with peers, and also under the guidance of an expert adult. Goldstein, Crowell & Kuhn (2009) demonstrated that incorporating collaborative exercises focused on argumentation in the education curriculum can help middle-schoolers to achieve higher argumentative strategies. Additional to practice alone, Felton (2004) showed that structured reflection can help to significantly enhance the transference of these acquired skills of argument to other topics. Therefore, helping adolescents to understand the argument structure behind discourse, to reflect on it explicitly and to practice it in different contexts can lead to the development of more advanced and generalizable argumentative strategies characteristic of adult discourse.

In conclusion, Sections 3.1– 3.3 have sought to conceptualize and define informal reasoning and to present empirical evidence demonstrating that although children are now recognized to be capable of reasoning at a young age, there remains a great need to foster and shape their argumentative skills as even till late adolescence, they are observed to use less strategic, critical and flexible strategies. The development of informal

reasoning is also discussed and the lack of family research, as compared to classroom-based studies, highlighted. Informal reasoning has been found in recent empirical work to have associations with the development of personal epistemological beliefs, an area of growing interest for psychologists in its application to learning and child development. Epistemological beliefs are postulated to hold a powerful role in what and how one learns, thinks and reasons as individuals act in ways that are congruent with their knowledge (c.f. Hofer, 2004, Hofer & Pintrich, 1997). In the next chapter, the definition, models and research in the field of personal epistemology will be discussed.

CHAPTER 4
PERSONAL EPISTEMOLOGY

4.1 Conceptualization of Personal Epistemology

In the last five decades, psychologists adopted the term "personal epistemology" to describe how individuals form knowledge and how they come to know, the beliefs and theories they hold about this process, and how these beliefs affect and are affected by their cognitive processes of learning, thinking, shaping and understanding of the world (cf. Hofer & Pintrich, 1997). The origins of personal epistemology come from ancient philosophy, whereby for many centuries, philosophers have debated over the origin, nature, sources, limits, methods and justification of human knowledge (cf. Hofer, 2002; Muis, Bendixen & Haerle, 2006). Personal epistemology is actively constructed and complex and is situated on the highest level of meta-knowing (Kuhn, 2000). As mentioned, personal epistemology concerns wider beliefs on knowledge and knowing, that is, beliefs which deal with the source of knowledge, the structure and certainty of knowledge, and the justifications given for the acceptance or rejection of various pieces of information. In some theories, personal epistemology also extends to beliefs of learning.

There is a growing body of empirical research on personal epistemology encompassing different theories and its relation to other aspects of learning and understanding of the world but despite all this research, Hofer and Pintrich (1997) noted that "there is very little agreement on the actual construct under study, the dimensions it encompasses, whether epistemological beliefs are domain specific, or how such beliefs might connect to disciplinary beliefs, and what the linkages might be to other constructs in cognition and motivation" (p.89). Differences in defining the construct reflect the different theoretical assumptions the theorists have of the nature of personal epistemology, and debates regarding what should or should not be included are still ongoing, reflecting the complexity of this construct (Hofer & Pintrich, 1997).

Researchers mainly approach this construct in two ways, either as (a) a cognitive developmental structure (e.g., Perry, 1970; Boyes & Chandler, 1992), or (b) a set of beliefs, attitudes or assumptions that reflect cognitive processes (Schommer, 1994). The

former type proposes an invariant, hierarchical model that is structurally integrated, coherent and in a logically sequenced developmental process. It acknowledges different components of epistemological thinking, but the cognitive structures and the accompanying general levels or stages imply that these components are not separable and are not orthogonal, hence making these models unidimensional. In contrast, the latter type has chosen to use the terms position and perspective in a multidimensional conceptualization rather than accept the deterministic, integrative assumptions of hierarchical developmental models. Different epistemological components can be orthogonal and there can be variations within individuals. Thus, the difference between the assumptions of these two approaches lie in the relationship among the components or dimensions of the models. As Duell and Schommer-Aikins (2001) wrote: "If the theory is unidimensional, the assumption is made that if one dimension develops, the other dimensions also develop. However, if the theory is multidimensional, it suggests that if one dimension develops, the others may or may not develop. In short, the unidimensional theory looks at personal epistemology as an aggregate whereas the multidimensional theory looks at personal epistemology as a disaggregate as well as an aggregate. (p. 421)"

Additionally, different theories have their own justifications concerning their selection criteria for the inclusion or exclusion of certain dimensions that are postulated to approximate personal epistemology. Schommer-Aikins (2004) conceptualized nature of learning as one aspect of personal epistemology based on previous research which has shown learning beliefs to be linked with student performance. Two dimensions were postulated under this category – innate ability and speed of learning. However, Hofer & Pintrich (1997) suggested that personal epistemological beliefs should be restricted to individuals' beliefs about the nature of knowledge (i.e., source and structure) and the process of knowing (i.e., role of evidence and process of justifying knowledge). Beliefs about learning, intelligence and teaching should be excluded as the authors argued that these do not explicitly deal with the philosophical and psychological concepts of defining and justifying knowledge. Statistically, a lack of factorial validity in a dimension of learning -'fixed ability' - also supports the exclusion of learning beliefs dimensions (Clarebout et al., 2001).

On a different note, Greene, Torney-Purta and Azevedo (2010) argued for the inclusion of justification dimensions in personal epistemology, emphasizing that the justification of knowledge formed a core concept of philosophical epistemology where

psychological research in personal epistemology originates from. Hofer and Pintrich (1997) did include a dimension of justification in their theory, but Greene, Azevedo & Torney-Purta (2008) argued that the definition of this dimension was vague and not sufficiently elaborated on. They noted that "in philosophical epistemology, the nature and limits of knowledge do not refer to whether knowledge itself is simple or certain but rather what kinds of claims have the potential to be justified as knowledge" (Grenne et al., 2008, p.148). In Greene et al's model (2010), they elaborated on the justification factor by formulating two dimensions of justification – justification by authority and personal justification. The former refers to justifying knowledge based on its source while the latter justifies knowledge based on personal experience and observation.

Another ongoing debate in the field addresses if personal epistemology is domain-specific or domain-general (cf. Muis, Bendixen & Haerle, 2006). Although some researchers have found empirical support for domain-generality (e.g. Schommer & Walker, 1995; Schommer-Aikins, Duell & Barker, 2003), others have found that beliefs are domain-specific (e.g. Hofer, 2000). There are others, however, that propose beliefs to be both general and specific, and that there may be important interactions between the two (e.g. Buehl, Alexander & Murphy, 2002; Buehl & Alexander, 2001; Hofer, 2000). As Sternberg (1989) purports, the domain specificity/generality debate may create a false dichotomy and it may not be the case that one is right and one is wrong. Instead, there may be evidence to support a more balanced hypothesis. Muis, Bendixen & Haerle (2006) wrote "different epistemologies may apply to different domains of knowledge, but developmentally, predictable patterns in the development of epistemic beliefs across different domains may be similar." (p. 5). Schraw (2001) proposed one possibility in that domain-specific beliefs play a predominant role in task-specific facets of learning, whereas domain-general beliefs may be more influential in general motivation and academic engagement.

From briefly reviewing the problems faced with regards to the conceptualization of personal epistemology, one cannot help but notice that the process of defining this construct and establishing clear boundaries of inclusion and exclusion has been far from easy. However, despite having different focuses of inquiry, approaches, methods and populations, scholars have agreed that there are some points of convergence about what personal epistemology encompasses. A consensus can be seen across models where "the view of knowledge is transformed from one in which knowledge is right or wrong to a

position of relativism and then to a position in which individuals are active constructors of meaning, able to make judgments and commitments in a relativistic context" (Hofer & Pintrich, 1997, p. 121). Furthermore, there have been calls for unified models which have instigated some new developments in the field, namely models that integrate previous differences such as the domain-specific versus domain-general issue (Muis et al., 2006) and the developmental versus multidimensional issue (Greene et al., 2010).

For this dissertation, personal epistemology refers to the beliefs of the nature of knowledge and knowing such as the simplicity, certainty, source and justification of knowledge. Knowledge can be justified either through authorities or personal experiences (Greene et al., 2010). Similar to Hofer and Pintrich's (1997) conceptualization, the construct will exclude beliefs on learning as these beliefs do not explicitly deal with the philosophical and psychological concepts of personal epistemology. Developmentally, epistemological beliefs consist of different dimensions which can progress asynchronously. Collectively, beliefs typically progress through hierarchical stage-like stages from an absolutist black-and-white perspective to an evaluativistic multi-faceted perspective of knowledge and knowing. Furthermore, beliefs can be both domain-specific and domain-general with important interactions between them. Domain-specific beliefs can exist in different domains of knowledge, but there still exists overarching domain-general epistemological beliefs which form early in life and develop in a similar manner across the lifespan (cf. Muis, Bendixen & Haerle, 2006).

4.2 Relevant Models of Personal Epistemology

There exists a variety of personal epistemology models in the last four decades but the following section seeks only to review models and theories which are significant and relevant to informing the current work. This concerns the inclusion of children and adolescents in the theory; a factor not reflective of earlier models in the field, and the content of the methodology (i.e., links with informal reasoning and thinking). It is not a detailed comprehensive coverage of all that has been achieved in this growing field of interest. If such is needed, Hofer & Pintrich's (1997, 2002) excellent review or Hofer (2004) should suffice. There are three sections as follows: developmental, multidimensional and integrated models. Each section briefly introduces and highlights the main characteristics of the included models.

Developmental Models

The developmental models included in this section are (a) Perry's Scheme of Intellectual Development (1970), (b) King and Kitchener's Reflective Judgment model (1994), (c) Chandler et al.'s Model of Epistemic Development (2002), and (d) Kuhn et al.'s Epistemological Understanding Model (2000). Table 4-1 shows the main features of each model and their stage similarities.

William Perry's (1970, 1999) Scheme of Intellectual Development is often cited as an early piece of significant work which many later epistemological models are based upon (Chandler et al., 2002; Hofer & Pintrich, 1997). From longitudinal interviews done with Harvard university students, Perry found that college students understood and structured their educational experiences through beliefs concerning the nature of knowledge and the sources of knowledge, and not due to differences in their personality dispositions. Perry identified four main positions which are on a continuum of development – dualism, multiplicity, relativism and commitment to relativism.

Dualists have an absolute view of knowledge, with external authorities being experts and transmitters of knowledge. Knowledge exists in simple forms of right and wrong, with no position in between. As individuals become aware of different multiple opinions on a single matter, they transit to the multiplist position whereby authority figures are no longer the experts. Knowledge is subjective and relative, all opinions are equally valid and none is better than another. When the individual starts to recognize that some opinions are more defendable than others and that contextualized knowledge can be measured against some established standards for evaluating claims, he/she transits to become a relativist. Relativists recognize the significance of providing justifications and come to understand the difference between an opinion and a well-supported one. When one adopts a specific set of standards for evaluating knowledge claims and begins to make personal stands on issues, the final position of 'commitment to relativism' is reached, whereby one accepts responsibility for the judgments and decisions one makes based on his/her own understanding and experience in that issue.

Table 4-1. Developmental Models of Personal Epistemology

Stages / **Models**	***Perry's Scheme of Intellectual Development***	***King & Kitchener's Reflective Judgment Model***	***Chandler et al.'s Model of Epistemic Development***	***Kuhn et al.'s Model of Epistemological Understanding***
1. Absolute view of knowledge as fully reflective of external observations. Sees external authorities as sufficient experts and transmitters of knowledge. Justification is not needed.	Dualism	Pre-reflective Thinking	Realism	Realist – assumes knowledge to be copies of external reality
			Defended Realism – Aesthetics and taste are subjective, but all other kinds of knowledge are factual and objective	Absolutist – asserts that facts that can only be correct or incorrect
2. Subjective and relative knowledge. All positions are equally valid whereby justification is context-specific and individualistic.	Multiplist	Quasi-reflective Thinking	Dogmatism – Human rationality cannot be trusted, must depend upon some authority for "knowledge"	Multiplist
			Skepticism – "Knowledge" is not possible in any sense, one cannot trust human rationality	
3. Constructive view of knowledge. Recognizes the value of justifications and evidence and that knowledge claims can be evaluated and weighed. Realizes difference between an opinion and a well-supported opinion	Relativism	Reflective Thinking	Rationalism	Evaluativist
	Commitment to Relativism - Adopts a specific set of standards for evaluating knowledge claims and accepts responsibility for personal stands made on issues			
Unique features	Nine stages subsumed under the above-mentioned four levels	Seven qualitative stages subsumed under the above-mentioned three levels; uses ill-structured problems to elicit beliefs	Stages correspond to Piaget's cognitive developmental levels	Domain-specific beliefs occurring at different rates across five judgment domains

Change is brought about through cognitive disequilibrium; individuals interact with the environment and respond to new experiences by either assimilating them to existing cognitive frameworks or by accommodating the framework itself. Perry did not conduct further work to explore his conceptualization of epistemological learning, but he did hypothesize that changes in the nature of knowledge and the role of authority may lead to observable changes in one's manner of due to altered modes of learning and cognition. Perry's scheme made a major contribution to the field through his characterization and articulation of the dualistic, multiplistic and relativistic perspectives that defined the epistemological outlook of his college sample.

The significance of Perry's work can be seen in later models such as King and Kitchener's Reflective Judgment Model, Chandler et al.'s Epistemic Development Model and Kuhn et al.'s Epistemological Understanding Model. Perry's work laid the groundwork for the following decades of research, with these models tracing their origins back to his work (Hofer & Pintrich, 1997). Many later models based their work on his, and used his developmental stages as guidelines for their own conceptualizations.

King and Kitchener (1994) studied epistemic assumptions that underlay reasoning to solve ill-structured problems of late adolescents and adults. They found that these epistemic assumptions were significant in the employment of different problem-solving strategies when faced with ill-defined dilemmas, such as the trustworthiness of news reporting and the safety of using nuclear power. The development of assumptions individuals have about knowledge such as what can or cannot be known (i.e., assumptions about knowledge and reality), how one knows something (e.g., source of authority, external observations) and the certainty that individuals have about what they know showed an influence on their reasoning sophistication (King & Kitchener, 1994). The higher the reflective thinking level, the more complex the thought process becomes and a higher variety of strategies for problem-solving is observed. Similar to Perry's stage model, individuals progress through three developmental stages of pre-reflective, quasi-reflective and reflective thinking with thinking being increasingly seen as self-constructed and the heightening awareness of the role that justification and evidence play.

King and Kitchener (2004) found that increasing age and higher educational attainment were predictive of higher levels of reflective judgment. Undergraduates were found to display similar levels of reasoning across various types of ill-structured problems but differential levels of reflective judgment were evidenced with graduate students (King & Kitchener, 2002). King and Kitchener, alike to Perry's findings (1970) with college students, found that most first-year undergraduates displayed low-level epistemological thinking, with movement to the next level only seen in students' senior year.

However, Chandler et al. (2002) disagreed with Perry's (1990) and King and Kitchener's (2004) conclusions that individuals at the start of a university education were only capable of low-level epistemological thinking as these findings implied that children were incapable of having differential levels of epistemological thinking. Based on children's theory of mind literature, Chandler et al. (2002) argued that even at young ages, children can differentiate between their own mental states and others' and begin to show developing metacognitive understanding. Theory of mind research with children reflects fundamental beliefs of epistemological understanding – the concept that beliefs can be inaccurate (i.e., false beliefs tasks) and that certain knowledge such as aesthetics is subjective, with different individuals having varying opinions. By age eleven to twelve, children begin to exhibit cognitive skills capable of understanding constructive thinking. Chandler et al. (2002) attributed previous results which found only graduate students capable of advanced epistemological thinking to the issue of domain generality, as previous models assigned positions to participants based on the lowest rating across several domains (King & Kitchner, 2004). They postulated that epistemological thinking varied by domains, differentiating between ill-structured domains such as aesthetics which are perceived as having little epistemic content because people rarely make knowledge claims in these domains, and well-structured domains such as hard sciences as consisting of a great deal of epistemic content as they are perceived as being composed of knowledge claims not subjected to human interpretation and are seen as fixed and unchanging (Hallett, Chandler & Krettenauer, 2002). Epistemic content is situated on a continuum, with children's epistemological thinking hypothesized to advance first in domains of low epistemic content and then in domains of high epistemic content. Using Piaget's cognitive development theory as a basis, Chandler et al. predicted that the age at which development begins varies

according to the degree of epistemic content. Epistemological thinking in ill-structured domains is first advanced around the age of twelve while beliefs in well-structured domains begin to advance in adolescence.

Chandler's model of epistemic development (Chandler et al., 2002; Hallet et al., 2002) consists of four stages: realism, defended realism, dogmatism or skepticism, and rationalism. Naïve realists are similar to Perry's dualist and King and Kitchener's pre-reflective thinkers, they believe that knowledge is a direct observation from experience, and that disagreements occur when people have access to different facts but this can be easily resolved by identification of the discrepancy and rectifying it with the same information. Children at this stage can understand false belief, but do not yet have an interpretative theory of mind. Defended realism is the beginning of an interpretative mind, evidenced by a child's acceptance that some kinds of knowledge, mostly aesthetics, are based solely upon opinions. The next stage occurs when knowledge beyond aesthetics is now recognized as subjective and constructed. Individuals can have two responses to this recognition, either they become dogmatic and heavily rely on authority figures for knowledge and truth or they become skeptics, arguing that there is no objective truth, only subjective opinions. Finally, the last stage of rationalism involves using standards as means of justifying knowledge. Some knowledge claims are evaluated to be more justified than others.

Kuhn's model of epistemological understanding (Kuhn, Cheney & Weinstock, 2000) is similar to Chandler et al. (2002) as she views epistemological beliefs as domain-specific, but instead of well- versus ill-structured domains, she theorizes that epistemological belief development occurs across five judgment domains at different rates: (a) personal taste (e.g. music preference), (b) aesthetic judgment (e.g., art quality), (c) value judgment (e.g. families should be told how many children they may have), (d) facts about the social world (e.g. explanations of how children learn language), and (e) facts about the physical world (e.g. what atoms contain). These areas range from the very subjective, such as taste or aesthetics, to the seemingly more objective, such as physical facts (Kuhn & Weinstock, 2002).

Kuhn et al. (2000) conceptualized higher epistemological thinking as the careful balance between objectivity and subjectivity, with no one position overpowering the other. Similar to other developmental models, individuals are postulated to develop

from realist to evaluativist positions; the perception of knowledge advances from being fully objective to the recognition of subjective knowledge, then to the achievement of mature thinking when one sees the value of evaluating and discriminating between differing judgments in the seeking of objective truth in subjective knowledge. For subjective domains such as aesthetic and value judgments, the progression from absolutist to multiplist levels occurs earlier. In more objective domains such as social facts and physical facts, this development occurs later. Interestingly, development of the higher epistemological levels from a multiplist to evaluativist understanding occurs in the reverse direction, with objectivity first being reintegrated to more objective domains, then to the more subjective ones. The authors note though that beliefs of personal taste cannot be logically classified as evaluativist due to its idiosyncratic nature.

In conclusion, the above-mentioned developmental models share similar characterization of epistemological beliefs, whereby beliefs are transformed from an absolutist perspective to higher-level perspectives recognizing the constructive and relative nature of knowledge. Movement through epistemological thinking positions may not be continuous. Cognitive disequilibrium, which occurs when one faces a new experience that clashes with current beliefs, facilitates movement from one position to another although individuals can resist or avoid growth at times (Perry, 1999). However, this avoidance will not cause a permanent halt to development but may just temporarily delay the progress of development. Development may also be recursive, conceived of as a spiral rather than a linear progression (Chandler et al., 2002).

Multidimensional models

In contrast to developmental models, multidimensional models postulate a system of beliefs in which each belief can develop asynchronously from the rest. The multidimensional models consist of (a) Schommer-Aikin's model (Schommer, 1990), and (b) Hofer & Pintrich's Epistemological Theory (Hofer & Pintrich, 1997).

Table 4-2. Multidimensional Models of Personal Epistemology

Theory	**Categories**	**Dimensions**
Schommer-Aikins (Schommer, 1990)	Nature of Knowledge	Certain Knowledge, Simple Knowledge, Omniscient Authority
	Nature of Learning	Quick Learning, Innate Ability
Hofer & Pintrich (1997)	Nature of Knowledge	Certainty of knowledge Simplicity of knowledge
	Nature of Knowing	Source of knowledge Justification of knowledge

Schommer-Aikins radically changed the conceptualization in the field of personal epistemology when she theorized that epistemological beliefs should be viewed as a system of beliefs (Schommer, 1990), thus refuting the popular assumption at that time that beliefs changed at the same rate as modelled by the hierarchical developmental stage models. She proposed a belief system consisting of five dimensions that could vary asynchronously (Schommer, 1990; Schommer-Aikins, 2004). Based on Perry's (1970) work, she formulated three dimensions related to the nature of knowledge: (a) Certain knowledge – the stability of knowledge on a continuum ranging from unchanging to continually changing and context-dependent, (b) Simple knowledge – the structure of knowledge ranging from isolated unrelated pieces to interrelated integrated concepts, and (c) Omniscient Authority – the source of knowledge ranging from figures of authority to empirically-derived conclusions based on evidence and reasoning. Additionally, Schommer-Aikins noticed that beliefs about fixed intelligence and speed of knowledge acquisition showed an association with student performance and thus suggested that beliefs about the nature of learning should also be included in the construct (Schommer, 1990). She postulated two dimensions under the nature of learning: (a) Quick Learning – the speed of learning ranging from quick all-or-none to gradual acquisition, and (b) Innate ability – the ability to learn ranging from innately fixed at birth to being malleable and improvable over time and experience.

Additionally, Schommer-Aikins constructed the first quantitative measure of epistemological beliefs in contrast to the previous time- and labour-intensive qualitative method of interviews. Her Epistemological Questionnaire (EQ) about beliefs on knowledge and learning (Schommer, 1990) consists of items from her five postulated dimensions – Certain knowledge, Simple knowledge, Omniscient authority, Quick

learning and Innate ability – and has been used extensively on a range of populations - adults (Schommer, 1998), college students (Schommer, Crouse & Rhodes, 1992), high school students (Schommer, 1993) and middle school students (Schommer-Aikins, Brookhart, Hutter & Mau, 2000). However, the psychometric properties of the EQ have been questioned, as subsequent empirical work yielded four factors (Schommer, 1993; Schommer et al., 1992) or three factors (Schommer-Aikins et al., 2000) instead of the original five proposed. The inconsistent empirical results led to critiques of the reliability of the EQ, and some further questions concerning the validity of Schommer-Aikin's theoretical assumptions (Clarebout et al., 2001; Greene et al., 2008).

This debate led to other researchers modifying Schommer-Aikins' theoretically proposed dimensions and also the EQ (cf. Duell & Schommer-Aikins, 2001). Jehng, Johnson and Anderson (1993) removed the simplicity of knowledge belief and added a rigid learning belief, which is the belief in orderly step-by-step instructional procedures useful for problem-solving but which has not been found to foster higher level beliefs in learning. Kardash and Wood (2000) combined the EQ and Jehng et al.'s (1993) measure to form another questionnaire which assessed the speed of knowledge acquisition, structure of knowledge, knowledge construction and modification, characteristics of successful students and the attainability of truth. Schraw, Bendixen and Dunkle (1995) also attempted to improve Schommer-Aikin's questionnaire through the construction of the Epistemic Belief Inventory; it captured all five initial belief dimensions but with a considerably reduced set of items (Schommer's 63 versus Schraw et al.'s 28 items). This instrument provides an alternative to assess Schommer-Aikin's five dimensions and is easy to administer but a note of caution has been given to carefully examine the context of its items because some items have been found to differ considerably from that of Jehng et al's and Schommer's (Duell & Schommer-Aikins, 2001).

Additional to the criticisms on the psychometric properties of Schommer-Aikin's EQ, scholars have questioned its assumption of domain-generality (Wood & Kardash, 2000). Schommer-Aikin and colleagues have supported the notion of domain-general beliefs; referring to domain-generality as "if individuals tend to believe that knowledge is highly interrelated and that there are multiple answers to problems, then they believe this to be true of most domains" (Schommer-Aikins, Duell & Barker, 2003, p.351). College students were instructed to fill out the EQ twice; first contextualizing the items in the math domain and the next in the social science domain (Schommer &

Walker, 1995). Results showed that correlations between epistemological belief dimensions across domains were higher than cross-belief correlations. Schommer and Walker used these results as evidence of the domain independence of the model. In another study, Schommer-Aikins, Duell and Barker (2003) asked college students to fill out the questionnaire three times, once thinking about math, another about social science, and lastly about business. Results showed that epistemological beliefs between math and social sciences were highly correlated, as were beliefs between math and business. They used this to support their claim of domain generality in epistemological beliefs.

However other researchers have challenged these findings. Hofer (2000) pointed out that despite instructing participants to think about different domains, many items in the EQ were unrelated to the academic domains. Buehl and colleagues (2002) used four of Schommer's (1990) dimensions (omitting omniscient authority) and found that participants' epistemological beliefs differed significantly across the domains of math and history, thus supporting domain-specificity as opposed to Schommer's findings with the EQ.

Interestingly, Buehl and Alexander (2005) additionally found that epistemological beliefs may be both domain-specific and domain-general. They used a variation of Hofer's (2000) instrument to assess whether students clustered into distinct groups based upon their epistemological beliefs and if these clusters differed across domains of history and math. Four distinct clusters were identified in each domain, but these clusters could not be compared across domains. However, when these clusters were categorized as either naïve or adaptive, a statistically significant correlation with a medium effect size emerged. Thus, Buehl and Alexander (2005) suggests that while domain-specific epistemological beliefs can vary, there may be an overarching general level of sophistication that restricts this variance.

As briefly mentioned before, Schommer-Aikin's model has been criticized for its inclusion of nature of learning factors on the basis of its factorial validity (Clarebout et al., 2001; Hofer & Pintrich, 1997). Hofer and Pintrich (1997) also emphasized that nature of learning factors do not explicitly relate to the philosophical conception of epistemology in the sense of the definition or justification of knowledge and knowing. They argued that the exclusion of these factors would bring greater conceptual clarity to

the construct. Schommer-Aikin's (2004) has responded by defending these factors and has argued that learning beliefs reveal what students think about the source of knowledge and contribute to the understanding of how students made sense of knowledge and knowing.

Nevertheless, Hofer and Pintrich (1997) formulated their Epistemological Theory with the exclusion of Schommer-Aikins' nature of learning factors but kept nature of knowledge factors and included a new category of nature of knowing factors. Two dimensions exist under nature of knowledge: (a) Certainty of knowledge – the degree to which one sees knowledge on a continuum from being fixed and concrete to a more fluid changing view dependent on context, and (b) Simplicity of knowledge – the degree to which one sees knowledge on a continuum from an accumulation of discrete facts to a highly interrelated conceptual view. Two dimensions also exist under nature of knowing: (c) Source of knowledge – the origin of knowledge as residing external to self such as in external authority figures or residing internally from self as knower and one's ability to construct knowledge and make meaning through interactions, and (d) Justification for knowing – the ways of determining what beliefs qualify as knowledge, moving from "a continuum of dualistic beliefs to the multiplistic acceptance of opinions to reasoned justification for beliefs" (Hofer & Pintrich, 1997, p.120).

When Hofer and Pintrich's (1997) theory was first formulated, it was unclear if these beliefs were viewed as domain-specific or domain-general, although they suggested that domain-specificity may be conceptualized as being specific to general academic areas such as math or history. However, Hofer's (2000) study provided support for the domain-specificity of epistemological beliefs through an empirical study which used the Discipline-Focused Questionnaire; a measure developed from their theory. Data was collected in the domains of psychology and science. Results showed that significant differences were found between the two domains. While moderate correlations were found between dimensions across domains, a multivariate analysis of variance showed that students' beliefs differed across domains for each dimension. Thus, Hofer (2000) argued that the evidence supported domain-specificity of epistemological beliefs.

Hofer and Pintrich have been criticized for the vague elaboration of their justification for knowing dimension. Greene, Azevedo and Torney-Purta (2008) argued

that Hofer and Pintrich did not elaborate upon this dimension beyond a reprisal of Perry's three general positions whereby development occurs from a dualistic to multiplistic to a rationalist perspective and highlighted that most models of personal epistemology thus far have neglected the justification of knowledge aspect. They noted the irony in this as the field of philosophical epistemology where personal epistemology is formulated from, justification was and still is a central question. Justification can be made through different ways such as appealing to rationality, sense data, and the coherence of new claims with other claims already established as knowledge (Greene et al., 2008). In the Epistemic and Ontological Cognition Model formulated by Greene and his colleagues (Greene et al., 2008) reviewed in the next section, they expanded on this concept of justification and tried to quantitatively measure individuals' beliefs in two modes of justifying knowledge claims.

Integrated Models

Bendixen and Rule (2004) and Hofer (2004) have both indicated a need in the personal epistemology field for unifying terminology or unified models capable of clear articulation of the relationship between personal epistemology and how epistemological beliefs change and develop. Greene et al. (2008) pointed out that this lack may be one reason why numerous debates within the field go unresolved. Since Hofer and Pintrich's (1997) definitive review of the field, the similarities and differences between various epistemological theories have been made known. Some of these issues debate over if epistemological thinking should be formulated in developmental stages or as independent dimensions, which dimensions are most indicative of the construct, and if beliefs are domain-general or domain-specific, or if they could be both. It is important to address these problematic issues to guide future research for development of more accurate self-report instruments and to clarify relations of epistemological beliefs with aspects of cognition and motivation (Schraw, 2001).

In this section, we discuss two models which have attempted to integrate some differing perspectives of the field. They are (1) Muis, Bendixen & Harle's Theory of Integrated Domains in Epistemology (2006), and (2) Greene, Azevedo & Torney-Purta's Epistemic and Ontological Cognition Model (2008).

1) Theory of Integrated Domains in Epistemology (Muis, Bendixen & Harle, 2006)

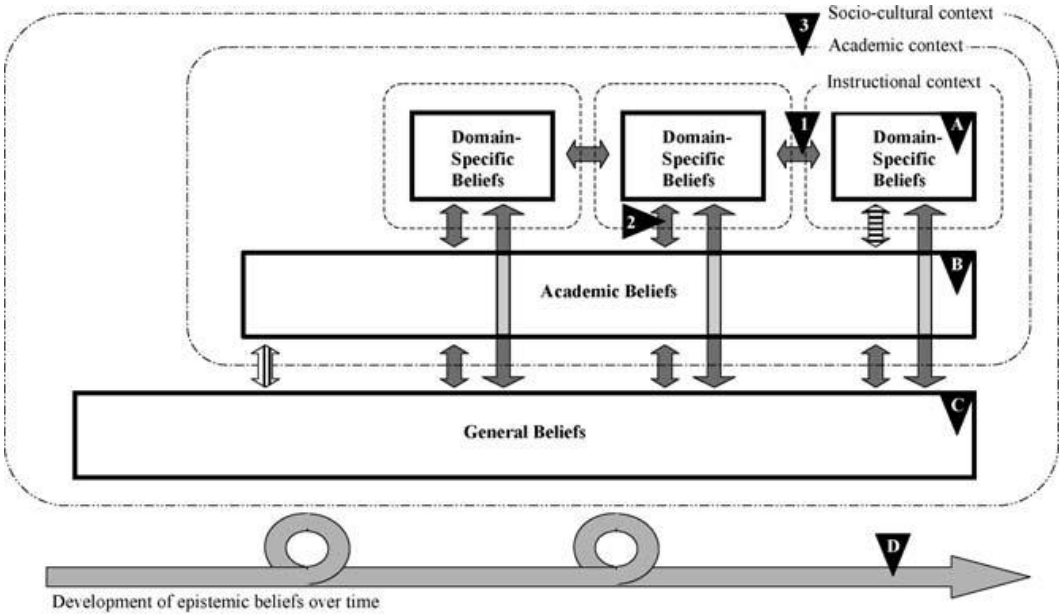
Muis, Bendixen and Harle (2006) proposed their own integrated theory addressing the domain-specificity issue in the field, incorporating philosophical considerations and the multidimensional and developmental personal epistemology paradigms. They noted that on one hand, some researchers have empirically supported domain generality using correlational analyses of beliefs among various domains (Schommer & Walker, 1995; King & Kitchener, 2004), while on the other, others have supported domain specificity by showing significant differences between beliefs in various domains (Hofer, 2000). These disparities in beliefs can be evidently seen across well-structured and ill-structured domains. In between-subjects design studies, individuals who majored in well-structured domains tended to believe that knowledge was more structured and certain and were more likely to rely on experts as sources of knowledge and justifications for knowing. In contrast, majors of ill-structured domains tended to believe knowledge was less structured, choosing to place more trust in personal experience (King, Wood & Mines, 1990). These results were also replicated in within-subjects studies; individuals believed that well-structured domains such as mathematics or chemistry consisted of knowledge which was more structured and more certain and were more reliant on experts for knowledge and justifications in these domains than in ill-structured domains such as psychology or business (Hofer, 2000; Schommer-Aikins et al., 2003).

Additionally, there is a third perspective that beliefs can be both general and specific with interactions between the two (c.f. Buehl et al., 2002; Buehl & Alexander, 2001; Chandler et al., 2002). Using the EQ to measure beliefs in mathematics and history, Buehl et al. (2002) formulated structural models positing both domain-generality and specificity and evaluated them empirically using confirmatory factor analysis. The model representing domain-specific belief factors was found to exhibit the best fit, but the significant correlations between the factors also suggested the existence of overarching domain-general beliefs. Buehl and Alexander (2005)'s study empirically supported this finding of superordinate domain-general epistemological beliefs. Using cluster analyses, epistemological beliefs of participants were grouped into interpretable profiles within the domains of history and mathematics. After evaluating the sophistication of these epistemological profiles, participants' profiles were found to be significantly correlated across domains. Students tended to possess similar levels of

epistemological thinking sophistication across history and mathematics. Chandler et al. (2002) have also supported the possibility that both domain-specific and general epistemological beliefs can work together.

Muis et al. (2006) supported the third perspective that epistemological beliefs were both general and specific and proposed their multilayered Theory of Integrated Domain of Epistemology (TIDE); a framework which aimed to "(1) provide a theoretical basis from which to understand and empirically assess domain-specificity and domain-generality and how the two are related, (2) establish a common language for describing domain-specific and general epistemic beliefs, (3) permit comparisons of data across paradigmatic approaches, and (4) provide a theoretical framework from which to discuss broader relations among epistemic beliefs and various facets of cognition, motivation and achievement" (Muis et al., 2006, p. 30). Epistemic beliefs were considered in three different but related contexts – socio-cultural, academic and instructional – to achieve a more fine-grained understanding of how beliefs develop within each context.

Figure 4-1. Theory of Integrated Domains in Epistemology (TIDE)



Note: "1" connotes similarities and differences across domains, "2" represents similar underlying epistemological dimensionality, and "3" refers to socio-cultural and environmental influences.

Referring to Figure 4-1, Muis et al. (2006) suggested that the development of general epistemic beliefs has to be considered in the sociocultural context, beginning at birth and continuing in development until the end of life. These beliefs are defined as "beliefs about knowledge and knowing that develop in nonacademic contexts" (p.33)

such as the home environment, peer interactions, in work related environments and other nonacademic environments. This development aligns itself well with the 'theory of mind' literature which has shown that children at young ages are aware of mental states, able to provide justifications for their answers and have begun to develop naïve theories of knowledge before formal schooling.

The development of individuals' academic and domain-specific epistemic beliefs, which are also socially constructed and context bound, begins when formal education begins. Academic epistemic beliefs are "beliefs about knowledge and knowing that begin to develop once individuals enter an educational system" (p. 35). These beliefs are initially more reflective of general epistemic beliefs but become more distinct over time. Early on, students develop academic epistemic beliefs that generalize across domains. However, with increasing expertise and exposure over time, students begin to formulate specific beliefs about various domains and these domain-specific beliefs, defined as "beliefs about knowledge and knowing that can be articulated in reference to any domain to which students have been exposed" (p. 36), become more influential than general beliefs. These domain-specific beliefs are shaped by the instructional environment, which includes grading and school policies and practices. Domain-specific beliefs continually evolve over the course of life but primarily develop during the academic years.

Reciprocity exists between general, academic and domain-specific epistemic beliefs. Initially, young children's academic epistemic beliefs are more influenced by general epistemic beliefs. As individuals progress through higher levels of education, general epistemic beliefs become less dominant and domain-specific epistemic beliefs become more influential. The TIDE framework consists of various levels which are reciprocally influential. Developmental progression occurs in two directions – a horizontal moving from an absolutist to evaluativist perception across the course of lifetime and a vertical upwards fine-tuning of beliefs through life experiences and educational experiences accumulated over time. The looped arrow in Figure 3-1 demonstrates the postulated recursive and spiral-like nature of epistemological development. Muis et al. (2006) theorized that changes in educational context may serve as impetus for recursion to occur as when exposed to unfamiliarity, individuals may choose to retreat to less sophisticated epistemological beliefs so as to protect their

security of the familiar. Intense initial scaffolding given by teachers is suggested to help students maintain levels of sophistication of their epistemological thinking.

Therefore, the multilayered framework of TIDE formulates an integrated theory which suggests that epistemic beliefs can be both domain-specific and domain-general and attempts to explain the associations and development of these beliefs across various contexts. TIDE brings greater specificity to the definition of epistemological beliefs by differentiating between general, academic and domain-specific beliefs. In embedding these belief types in sociocultural, academic and instructional contexts, the theory also seeks to explain how these epistemic beliefs develop in relations to life development and situational changes and their relations to cognition, motivation and learning.

2) Epistemic and Ontological Cognition Development Model (Greene, Azevedo & Torney-Purta, 2008)

The next integrated model of personal epistemology is that of Greene, Azevedo and Torney-Purta's (2008) – the Epistemic and Ontological Cognition Development Model (EOCM). The EOCM integrates the characteristics of both developmental and multidimensional models into one model and includes the covariate of educational level to hypothesize the occurrence of changes in epistemological thinking, as informed by past child developmental literature. The EOCM supports the domain-specificity of epistemic beliefs and makes the differentiation between ill-structured and well-structured domains.

Past literature has used the terms 'epistemological beliefs' and 'epistemic beliefs' interchangeably as they fundamentally refer to the same construct. Greene et al. (2008) coined the term "Epistemic and Ontological Cognition (EOC)" as they argued that "personal epistemology" or "epistemological beliefs" are misnomers because "epistemology" literally means "the study of knowledge" and not all individuals consciously study knowledge as implied by this concept (cf. Kitchener, 2002). Instead, most individuals have beliefs about knowledge, thus the terminology of 'epistemic belief' is deemed as more accurate. Additionally, researchers studying epistemic beliefs also study the processes which form these beliefs and their consequent influence on learning. Thus 'ontological cognition' is also included in the terminology of EOC as it

'emphasizes knowledge and the processes involved in its definition, acquisition and use' (Greene et al., 2008, p.143).

Table 4-3. Epistemic and Ontological Cognition Development Model (Taken from Greene et al., 2008)

	Ill-Structured Domains				***Well-Structured Domains***			
Age	***Position***	***SC***	***JA***	***PJ***	***Position***	***SC***	***JA***	***PJ***
4-12	Realism	High	High	High	Realism	High	High	High
12-Early College	Dogmatism	Low	High	Low	Realism	High	High	High
	Skepticism	Low	Low	High				
Mid to Late College	Rationalism	Low	Mid	Mid	Dogmatism	Low	High	Low
					Skepticism	Low	Low	High
Graduate Education	Rationalism	Low	Mid	Mid	Rationalism	Low	Mid	Mid

SC = Simple and Certain Knowledge Dimension; JA = Justification by Authority Dimension; PJ = Personal Justification Dimension

The EOCM measures individuals' beliefs along three dimensions: Simple and certain knowledge, Justification by authority, and Personal justification. The dimension of simple and certain knowledge was formulated by collapsing the separate and certain knowledge dimensions of Schommer-Aikin's (2004) and Hofer and Pintrich's (1997) into one dimension as empirical studies utilizing factor analyses have supported a single dimension rather than separate ones (Hofer, 2000). Greene et al. (2008) also theorized that someone who has a simple view of knowledge is unlikely to see it as uncertain and vice versa. The other two dimensions focused on the concept of justification, an aspect that Greene et al. (2008) have noted to be neglected in previous work in personal epistemology although it is central to the concept of epistemology. The justification dimensions attempt to measure "the degree to which an individual feels that particular sources are sufficient to warrant a knowledge claim" (Greene et al, 2008, p. 237). The two dimensions are conceptualized on the theoretical basis that when faced with a disagreement of knowledge, individuals usually choose one of two paths to justification. They either decide that all claims are subjective and personal, thus warranting knowledge claims based on personal experience and logic (i.e., personal justification), or rely on some authority figure for guidance and say they "know" something if an expert, teacher or other reputable source said it (i.e., justification by authority). Differences in these dimensions are posited to be quantitative in nature and the extent of their belief in each dimension is quantified under terms of strong/moderate/weak agreement.

The EOCM uses quantitative differences in dimensional EOC beliefs to characterize individuals into qualitatively different positions. Similar to the levels of Chandler's Model of Epistemic Development (Chandler et al., 2002; Hallett et al., 2002), the EOCM is composed of four positions – realism, dogmatism, skepticism, rationalism. Each of these four positions suggests a distinct profile of the dimensional EOC beliefs. The first position in the model is realism, characterized by strong beliefs in all three dimensions. Individuals in this position see knowledge as objectively knowable, making almost any means of justification sufficient to warrant a knowledge claim. When individuals recognize that knowledge is not objectively knowable and become aware of the need to evaluate warrants to establish justification, they move into either dogmatism or skeptiscism. Dogmatists rely on authority figures to provide the justification necessary to warrant their knowledge claims while skepticists believe that their own personal experiences constitute sufficient justification. Because this experience is inherently subjective, it is not comparable across individuals. Finally, with experience and reflection, individuals develop into rationalists. They continue to believe that knowledge is complex and dynamic but take more nuanced positions toward means of justification. They see that justification is sometimes warranted by a figure of authority while at other times, justification with personal experience or reasoning may be sufficient. By using both authority-based and personal means of justification, mature individuals come to a rationalist view of knowledge.

The EOCM postulates two developmental aspects. First, there is a progression between domains regarding when cognition matures, starting first with ill-structured domains followed after by well-structured domains. Maturity of cognition is indicated in the model with reference to age periods and educational level corresponding to changes in EOC. These occurrences of change are educated guesses informed by developmental psychology work on children's cognition and past epistemological research such as that of King and Kitchener's (c.f. Greene et al., 2008). Secondly, alike to developmental theories, individuals move in a predictable progression through the four positions from realism to rationalism within each domain.

In line with Muis et al. (2006) and Buehl and colleagues (Buehl & Alexander, 2001, 2005), Greene et al. (2008) agrees that individuals' EOC varies across domains, although they hypothesize that EOC varies at a level somewhat between domain-generality and specificity. More specifically, they suggest that these differences exist at

the level of well- versus ill-structured domains. Greene et al. (2010) created a quantitative instrument based on the EOCM, entitling it the Epistemic and Ontological Cognition Questionnaire (EOCQ). The EOCQ consists of items in two domains: the ill-structured domain of history and the well-structured domain of mathematics. Using confirmatory factor analyses and factor mixture modelling on data collected from middle school to graduate school participants, results confirmed the theoretical basis and provided some empirical support for domain-specificity. They hypothesized that domain-specific beliefs developed at differential rates, with beliefs first maturing in ill-structured domains before well-structured domains. This was found to be true when beliefs in history were found to be at least or more sophisticated than beliefs in mathematics (Greene et al., 2010). Educational level and academic performance were also found to predict the EOC position of the individual, thus supporting the predictive validity of the model regarding these covariates.

In conclusion, the EOCM integrates the developmental and multidimensional perspectives in the field and uses covariates of maturing cognition such as age and education to make predictions of the EOC positions that individuals are at. Individuals typically progress from the low-level position of realism to being dogmatics or skepticists, and lastly to high-level rationalist positions. These qualitatively different positions are characterized by quantitative differences across the three dimensions of simple and certain knowledge, personal justification and justification by authority. The model differentiates between ill-structured and well-structured domains, with some first empirical results supporting domain-specificity of epistemic and ontological cognition (Greene et al., 2010).

4.3 Development of Personal Epistemology

Muis, Bendixen & Haerle (2006) writes that “personal epistemology is complex and socially constructed; that is, individuals actively construct or make meaning of their experiences, and development occurs as a function of one’s interactions with the social world” (p.30). The child’s world mainly consists of three basic influences - family, peers and teachers (Schommer-Aikins, 2004). These three spheres make up the core of the child’s social world, thus playing important roles in the manner a child comes to understand the nature, limits and certainty of knowledge. These representations of

knowledge and knowing are developing and changing over time and subsequently have an influence on the way children approach the process of learning (King & Kitchener, 2002).

The development of epistemological understanding has been postulated to be recursive, as opposed to linear development presumed by early studies whereby the process of epistemological understanding was suggested to mainly begin when students entered university as many first-year students were found to function at the lowest epistemological level of dualistic absolutist views of knowledge (Perry, 1970; Kitchener & King, 1994). Boyes and Chandler (1992) however found all four of the epistemic levels posited in their model in their sample of high school students. They subsequently theorized that previous studies showing low-level epistemic beliefs in first-year university students could suggest a spiral-like development of epistemological thinking, as students may retreat to safer, more established positions when exposed to new environments. The anxiety and negative affect one experiences when pre-held notions and ideas are challenged can bring confusion and may cause the individual to retreat for stability and security. This is supported by Muis et al. (2006), who suggested that transitions through the different levels of education can be particularly stressful and can cause individuals to return to lower levels of epistemological thinking.

As mentioned before, in spite of various approaches and methodologies, the developmental trend of epistemological thinking is generally agreed to undergo transformations from a dualistic view of knowledge as being right or wrong, to a view of relativism where knowledge is self-constructed and open to different interpretations, and finally to an evaluativistic rationalism whereby individuals are able to make their own personal judgments and commitments in a relativistic context. There has been little empirical evidence for the precise factors that alter epistemological beliefs but it has been theorized this development may be caused by an interactionist disequilibrium mechanism from the Piagetian perspective. Cognitive disequilibrium acts as a trigger to assimilation or accommodation (Hofer & Pintrich, 1997). Change occurs when individuals become unsatisfied with existing beliefs, find new alternatives intelligible and useful, and see a way to integrate the new beliefs with earlier conceptions. Perry (1970) described the motivation for development as an interaction between internal motives toward autonomy and external environmental support and constraints.

Given the sample populations of most studies, the environmental press for change often seems to come from educational encounters (c.f. Muis et al., 2006; Hofer & Pintrich, 1997). Schools shape and change epistemic beliefs through teacher modelling and act as a training ground for children to think, use and modify their views of knowing as they develop critical thinking skills (Shraw, 2001). Higher education with its highly rational, objective and intellectual process of knowledge seeking has been shown to consistently correspond with more sophisticated and mature epistemological understanding (Kuhn, 1991; King & Kitchener, 1994). However there remains a need to understand how motivational mechanisms and contextual factors in educational settings constrain or facilitate such changes as most research has examined epistemological beliefs in a relatively decontextualized manner. Hofer and Pintrich (1997) suggested that there should be more exploration on how beliefs are communicated in the classroom environment. Schommer-Aikins (Schommer, 1990) suggested that "teachers can inform children in grade school that knowledge is integrated, that prior knowledge should be processed, and that many times there is more than one right answer" (p. 503-504).

Kuhn, Cheney & Weinstock (2000) have also suggested that other than educational experiences, other experiential factors such as the intellectual climate and values of society can influence the development of epistemological understanding. Their empirical results showed that across a sample of various ages and educational levels, the transition from absolutist to multiplist level could be easily achieved by almost all individuals in each sub-sample. In contrast, the transition from the multiplist to evaluativistic level was achieved by less than half of the participants in each sub-sample. They cited wider societal and cultural values to be a possible reason. The value of social tolerance and acceptance is a common characteristic of the modern western society in which every individual is entitled to have his/her own opinion and respect has to be accorded to all opinions. Kuhn et al. (2000) argued that this value of social tolerance and acceptance can produce a slippery slope and blurred boundaries concerning the belief of individual right to opinion and the belief that all opinions are equally right. Tolerance of multiple opinions can thus overshadow the significance of discriminating claims based on reasoned arguments.

Similar to the reasoning field, there is more empirical literature on epistemological beliefs in school and classroom settings as compared to home settings.

This can be partially attributed to the predictive power of epistemological beliefs regarding numerous aspects of learning and performance, such as in comprehension of text (Schommer et al., 1992) and on their grade point average (Schommer, 1993). The role of schools and the wider society is undoubtedly significant to the development of epistemological thinking but the role of the home environment in this development has often been sidelined. Anderson (1984) has suggested that epistemological beliefs are a product of both the home and formal education: "… children not only acquire experience, they acquire interpretations of experience. It stands to reason that the beliefs about knowledge that a child develops will be influenced by those of his parents. Parents' beliefs about knowledge will be conditioned by educational and occupational status… Later, teachers become mediators of experience." (p.9). Anderson (1984) thus suggested that a child's beliefs about knowledge are first influenced by his or her parents. Muis et al.'s (2006) TIDE model supported Anderson's view by postulating that domain-general epistemic beliefs begin to develop before the commencement of formal education. These beliefs originating from family influence are subsequently carried over to educational processes, which are further shaped by teachers, peers, classroom communication and schooling processes.

Schommer-Aikins' (2004) embedded systemic model acknowledged the integral role of family, amongst other influences of peers and schools, on individual learners of personal epistemological beliefs. Families have their own system of cultural views, ways of knowing beliefs, epistemological beliefs and all these play a role in influencing the learner embedded in the family. However, there have been few studies that attest to the influence of family in the development of epistemological beliefs. Schraw (2001) wrote that "little is known about the origin and development of individuals' epistemological beliefs" (p.457). The antecedents of epistemological beliefs have been less explored in comparison to their consequences, which mainly revolve around their linkages with learning and academic performance. The few empirical studies that exist are by Schommer-Aikins who demonstrated the significance of the home environment to the development of epistemological beliefs (Schommer, 1990, 1993).

In the first study, Schommer-Aikins (Schommer, 1990) tested the conceptualization of epistemological beliefs as a multidimensional construct by administering the EQ to junior college and university students. In her study, she also included some questions about home background and upbringing. These questions

included various aspects: educational atmosphere and opportunity (e.g., parents' higher education and parents' occupational prestige score), encouragement towards independence (e.g., making decisions for oneself) and adherence to rules (e.g., enforcement of strict rules). Results found that two epistemological belief dimensions were found to significantly relate to three types of predictors. Simple knowledge was predicted by educational atmosphere and opportunity (high level of parental education), encouragement towards independence (questioning parents' decisions) and adherence to rules and guidelines (strictness of rules in the family). Quick learning was predicted by educational atmosphere and opportunity (father's education), and of encouragement towards independence (discussions). The remaining two belief dimensions, innate ability and certain knowledge, were not significantly predicted by any variable measured. Schommer-Aikins wrote that "these results suggest that the more education parents have and the more they expect their children to take responsibilities in the home and in their own thinking, the more likely children will develop a sophisticated system of epistemological beliefs" (Schommer, 1990, p.503).

In a later study, Schommer-Aikins (Schommer, 1993) questioned if possible differences in epistemological beliefs could be due to school type (junior college and university) and domain expertise (social sciences and technological sciences). Her results further found that some of these differences could be attributed to different students' family characteristics. Schommer-Aikins found that parental education and encouragement towards independence predicted beliefs in simple knowledge. Parents with a higher level of education might give their children more encouragement to think independently. Consequently, these children as adults were less likely to believe in simple knowledge than children from less educated parents. Secondly, parental education, log of school year and gender predicted quick learning. The more education parents had and the further along in school participants were, the less likely these participants believed in quick all-or-none learning.

Additionally, Cano & Cardelle-Elawar (2008) investigated if familial variables of parents' educational level and family's intellectual climate, that is, the family's degree of interest in social, political, cultural and intellectual activities, could act as predictors of epistemological beliefs. In a sample of secondary school students ranging between 12-18 years of age, epistemological beliefs were measured by the EQ. Their results showed that parents' educational level and family's intellectual climate both

significantly predicted epistemological beliefs in quick learning, that is, the speed and effort involved in learning. Similar to Schommer-Aikins' results (Schommer, 1990; 1993), the lower the educational levels of parents, the more likely children developed naïve beliefs about quick, effortless learning. Additionally, the better the family's intellectual climate, the more sophisticated the child's beliefs were about learning. Conley, Pintrich, Vekiri & Harrison (2004) additionally found that although family socio-economic status (SES) did not significantly influence elementary students' epistemological beliefs over time, low SES students reported more naïve beliefs (e.g., certain knowledge and source of authority) than average SES students.

Till now, the above-mentioned studies have dealt with how parental educational level and parenting practices can shape children's epistemological beliefs. Gerber (2004) tested if direct relations existed between parents' and children's epistemological beliefs. In testing for intergenerational transmission of beliefs, she developed scales largely based on Schommer's (1990) multidimensional model for purposes of measuring parental and child epistemological beliefs. Although significant correlations between beliefs of parents and child were found, these were not in the same dimensions.

Kuhn (2005), however, found that when parents evidenced higher epistemological understanding and valued inquiry, their children were also more likely to show similar beliefs. Students in a best-practice middle school were more likely to espouse higher epistemological understanding and place higher value on inquiry and debate than students from struggling schools. Only parents from the best-practice school participated in her study and the results revealed that 82% of these parents functioned as evaluativists and 77% valued debate. Kuhn thus concluded that in the best-practice schools, "these middle-schoolers belong to a subculture in which such values are the norm and they are highly likely to come espouse them themselves" (p.35).

In sum, the results of these studies confirm that family life predisposes children to have certain epistemological beliefs, which have been shown to have subsequent impact on learning and academic performance. However, these empirical studies have evidenced some weak empirical links and inconsistent findings, which call for further research to verify and support these claims.

4.4 Parental Epistemological Understanding and Parental Practices

The transmission of parental beliefs to children may also depend on the linkages between parental epistemological beliefs and their behaviours towards the child. Parental epistemological beliefs may shape and influence parents' choice of parenting strategies to be more authoritative. Conversely, they can also cause parents to adopt more controlling and restrictive practices.

Gerber (2004) found that when parents had more relativistic perspectives on the complexity of knowledge, parents employed more autonomy-supportive practices. The more parents recognized that knowledge is dynamic, interrelated, and subjected to questioning and confirmation, the more they reported exhibiting behaviours which were supportive of children in the learning process such as using autonomy-supportive instructional processes. Interestingly, child-perceived autonomy-supportive behaviour was not associated with children's level of epistemological thinking in the expected way.

Bond and Burns (2006) showed that parents who displayed higher levels of epistemological beliefs had less categorical and more multi-faceted conceptions of child development. From interview data, these mothers perceived child behaviour as dynamic, multi-dimensional and context-oriented instead of single and static. In recognizing the multiple influences on child behaviour, these parents were more flexible and responsive to children's behaviour. A greater understanding of the complexity of child development is associated with higher social and cognitive competence in children (Sameroff & Seifer, 1983). In addition, mothers who had more advanced epistemological beliefs used less authoritarian and coercive communication strategies. As knowledge was seen as dynamic, subjected to manipulation and modification by human experience and interaction, and continually refined through analysis and evaluation, these mothers used more cognitively challenging strategies such as engaging their children in more active reasoning as well as self-directed problem-solving. In contrast, mothers who were found to have lower-level epistemological beliefs displayed more categorical and less perspectivistic conceptions of child development, and were more ready to endorse authoritarian, controlling and power-oriented communication strategies.

Furthermore, Ricco and Rodriguez (2006) found that mothers with more sophisticated epistemological beliefs employed an authoritative parenting style and preferred learning-oriented academic goals for their child. Measuring epistemological beliefs of 163 college mothers from primarily working class backgrounds with five dimensions of learning ability, speed of learning, structure of knowledge, knowledge construction and source of knowledge (Wood & Kardash, 2002; Hofer, 2000), correlational analyses revealed that authoritative parenting was exclusively associated with beliefs of active self-constructed knowledge and with learning being more effort-based and within the control of the learner. Mothers who showed more complex epistemological beliefs preferred learning goals as opposed to performance goals, where improvement and effort in the process of learning is emphasized instead of performance outcomes. In contrast, beliefs that innate ability is fixed from birth and that knowledge pieces are separate and discreet were associated with authoritarian and permissive parenting. These parents tended to apply little critical thinking to sources of knowledge and were often fully trusting of words of experts or texts. They were more focused on performance goals, emphasizing ability level shown through outcome variables such as grades and rankings. Using stepwise regression analyses, parental epistemological beliefs were found to remain as significant predictors of parents' academic goals (learning versus performance) even when parenting style was controlled for.

In conclusion, empirical studies reveal that parental epistemological beliefs have an influence on their beliefs of child development, parenting styles and their academic goals for their children. Empirical research documenting parental epistemological beliefs per se is still scarce, although these beliefs seem significant for more effective parenting. It is thus important to further investigate the extent that parental epistemological beliefs affect parenting and if they do hold significant influence, there is the added question of what supports need to be set in place to aid and shape these parental beliefs for more effective parenting.

4.5 Association of Reasoning and Personal Epistemology

Empirical work has shown that skilled reasoning can be enhanced or constrained by epistemological beliefs, especially in the domain of scientific reasoning (Kuhn, Iordanou, Pease & Wirkala, 2008; Yang & Tsai, 2009). The representations of

knowledge and knowing that children bring to education and learning have been suggested to help or hinder their development. Education is a constructive process and educators are increasingly being made aware that "one of these quiet but powerful frameworks is the epistemological beliefs that students... hold" (Alexander, Murphy, Guan & Murphy, 1998, p.97). Skilled argumentation in the scientific domain is associated with more mature understandings of the epistemological foundations of science; the recognition that scientific knowledge is constructed by humans rather than simply discovered in the world (Kuhn et al., 2008). Skilled reasoners employ a "critical epistemology", in which both sides of an issue are examined; in contrast, less skilled reasoners employ a "make-sense epistemology" in which arguments are deemed acceptable if they make intuitive sense, that is, if they appear to be true (Perkins et al., 1983). When dealing with ill-structured problems that have no single and definitive solution, assumptions about knowledge and knowing are often implied (King & Kitchener, 1994; Kuhn, 1991; Schraw, Dunkle, & Bendixen, 1995, Mason & Scirica, 2006).

Kuhn (1991) investigated argumentative thinking in a range of populations from teens till age 60s regarding complex issues reflective of everyday phenomena such as the causes for prisoners to return to crimes or children failing in schools. Argument skills of participants were measured through participants' formulations of causal explanations for each of these phenomena, their provision of supporting evidence, their ability to generate a counterargument, to provide a rebuttal and to offer solutions to the problem. In the process of investigating how and why reasoning occurs through the generation, evaluation and justification of positions, Kuhn found that epistemological beliefs of individuals were simultaneously elicited. Her empirical results evidenced associations between evaluative epistemology and argumentative skill development. From interview data, Kuhn identified epistemological indicators which included questions regarding proof (e.g., could someone prove that you were wrong?), expertise (e.g., do experts know for sure what causes _____?), multiple viewpoints (e.g., could more than one point of view be right?), origins of theories (e.g., can you remember what it was that led you to believe that this is the case?) and certainty (e.g., how sure are you of your view compared to an expert?). Hofer and Pintrich (1997) noted that although multiple indicators of epistemological beliefs were identified, the development of epistemological categories was based only on questions regarding

expertise, and no specific information was provided about the procedure used. From her data, Kuhn found that participants could be categorized into three levels of epistemological understanding. She termed these levels absolutist, relativist and evaluativistic levels (refer to Section 4.2 for explanations). In examining relations of argument skills and epistemological beliefs, Kuhn found a positive relation between evaluativists and the display of higher argument skills, that is, the higher use of counterarguments and alternative theory generation. Individuals who held more sophisticated epistemological understanding may be more inclined to recognize the need to contemplate and evaluate alternative theories and evidence and see the value of argument. Kuhn thus concluded that "it is primarily the emergence of the evaluative epistemology that is related to argumentative skill development" (Kuhn, 1991, p.195).

A later study by Kuhn (2005) also found the association of epistemological understanding with intellectual values of inquiry and debate in middle schoolers at a best-practice school. These intellectual values may build the foundation for good and effective reasoning. Kuhn (2005) administered measures of epistemological understanding (cf. Kuhn, Cheney & Weinstock, 2000) and intellectual values to students from sixth to eighth grades in two school types: the struggling school and the best-practice school. Intellectual inquiry was assessed by the question: "People usually have pretty good ideas about things. They can try to go out and get more information, but they'll probably find out that the ideas they started out with were the best ones. Do you strongly agree, sort of agree, or disagree? If you disagree, what do you think?" The intellectual value of argument and debate was measured by three open-ended questions on everyday phenomena such as social issues like death penalty and likes, on political candidates and on world peace. An example of the first issue is "Many social issues, like the death penalty, gun control, or medical care, are pretty much matters of personal opinion, and there is no basis for saying that one person's opinion is any better than another's. So there's not much point in people having discussions about these kinds of issues. Do you strongly agree, sort of agree, or disagree? If you disagree, what do you think?" Respondents'' intellectual values could not be judged by simply agreeing with the presented statements but rather, due to the statements being inverted, respondents had to disagree and to offer reasons for their disagreement. These reasons revealed the value they placed on discussion, inquiry and debate in enhancing individual or collective understanding, problem-solving and conflict resolution. The results showed

that best-practice school students were more likely to see inquiry or debate as valuable, and were more likely to have reached the evaluativist level of epistemological understanding whereby even in a relative context of knowledge claims, there remain answers which can be more justified than others.

Mason & Scirica (2006) confirmed this association and further found that epistemological understanding acted as a significant predictor of argument skills on controversial topics. Participants had to argue in favour of one view, and formulate arguments, counterarguments, rebuttals and justifications. In a sample of 62 eighth-graders, participants were asked to read two information-rich texts, one on the topic of global warming and the other on genetically modified food. Kuhn, Cheney & Weinstock's (2000) measure of epistemological understanding was used to measure epistemological beliefs. Additionally, measures of topic knowledge and interest concerning both topics were also given. For each topic, participants were asked a set of questions in which they had to formulate arguments, counterarguments and rebuttals, while providing justifications. The quality of argumentation was scored according to the number and content adequateness of the reasons given to support conclusions and measured for three main reasons: (1) no simple assertions were accepted but rather arguments supported by justifications; (2) only acceptability and relevance of justifications for supporting the conclusion were considered; and (3) arguments with a greater number of acceptable reasons were considered as stronger. Through multiple regression analyses, it was found that for the topic of global warming, only epistemological understanding but not topic interest or knowledge significantly predicted argument, counterargument and rebuttal generation. Using a further multiple analysis of variance, it was found that epistemological understanding levels (i.e., absolutist, multiplist and evaluativist) significantly differentiated argumentative skills, with participants at an overall evaluativist level outperforming those at multiplist level. In this study, no participants were coded as absolutists. For the topic of genetically modified food, epistemological understanding was again found to significantly predict the three components of argumentation. Additionally, topic knowledge was a significant predictor of rebuttal generation. Results revealed that epistemological understanding level significantly predicted argument skills, with participants at overall evaluativist level attaining higher scores than those at multiplist levels for all three components. The same pattern of results thus emerged for both socio-scientific topics. Epistemological

understanding contributed to the quality of participant's argumentative skills, with participants at the highest level of epistemological understanding (i.e., evaluativist) evidencing the highest generation of all three components of argumentation skills. Only for the topic of genetically modified food was the generation of rebuttals also related to prior knowledge about the question. This supported Means & Voss' (1996) finding that prior knowledge is significantly related to the number and types of reasons generated by arguing. Therefore, a clear outcome of this study is that the skill of generating a valid and effective argument on a controversial topic is associated with higher-level beliefs of knowledge and knowing. It highlights the importance of fostering students' epistemological thinking: fostering epistemological thinking in an instructional context means teaching students to value thinking and judgment, and helping them acquire and refine the skills of producing and evaluating reasoned arguments.

In everyday reasoning and judgment, epistemological understanding has been found to contribute to better reasoning skills and the overall production of arguments by prospective jurors (Weinstock & Cronin, 2003). Older high school learners who exhibit higher level epistemological beliefs are also more capable of identifying informal reasoning fallacies, although this ability to identify fallacies is also associated with grade level and cognitive ability (Weinstock, Neuman & Glassner, 2006).

From these studies, epistemological understanding has been found to be significantly related to and predictive of reasoning skills. This relation may also be bidirectional, as the teaching and refinement of reasoning skills in instructional contexts though the presentation of controversial topics may also help students to not only acquire and practice skills of generating and evaluating reasoned arguments, but also foster epistemological thinking in the sense of teaching students to value thinking and judgment. Mason & Scirica (2006) noted that "there could be a two-fold advantage in presenting students with controversial topics... understanding controversies requires epistemological thinking to deal with source, structure, and credibility of knowledge. At the same time having to deal with these aspects of the knowing process may stimulate and sustain the refinement of epistemological understanding" (p.505). Higher educational levels have been found to evoke higher level epistemological thinking. This can perhaps be partially attributable to the notion that more advanced levels of education tend to require higher skills of inquiry, reasoning and criticality, thus shaping more sophisticated epistemological beliefs in this process. However, it is important to

keep in mind that epistemological beliefs are mostly tacit, meaning that changes to these beliefs are often not directly observable and more significantly, empirically difficult to capture. However, changes in argumentative skills of reasoning are more concrete and measurable. Thus, changes in reasoning in relation to epistemological beliefs may be more empirically evidential than changes in beliefs in relation to reasoning.

In conclusion, Sections 4.1 – 4.3 have sought to conceptualize and define personal epistemological beliefs, to highlight the ongoing problematic debates in this field, to provide a succinct comprehensive review of relevant models and theories – developmentally, multidimensional and integrated – to the current work and to discuss the development of epistemological thinking. Similar to the empirical literature of informal argumentative reasoning, the scarcity of family-based research was noted. Section 4.4 highlighted the few empirical studies which showed the significance of parental epistemological beliefs for better and more effective parenting practices. Finally, Section 4.5 discusses the recent studies indicating the significant relation of argumentative reasoning and personal epistemology. A positive relation is posited between these two constructs– argumentative reasoning skills are found to be enhanced by more sophisticated levels of epistemological understanding, with the latter variable found to be predictive of the former.

CHAPTER 5
RESEARCH MODEL

5.1 Research Problems

Three research problems were identified from the reviewed literature on the constructs of informal reasoning and personal epistemological beliefs:

Firstly, in the field of reasoning, many empirical studies in psychology have been conducted in the scientific reasoning domain utilizing well-structured problems which typically involve one method of problem-solving and one fixed solution, often evoking formal reasoning processes. However, recent questions have been directed to the restrictiveness of such reasoning, and the importance of studying reasoning processes which can actually inform us about the reasoning individuals typically engage in during everyday lives. There is a need for children to have practicing opportunities for issues that may not be popular school material but holds high personal relevance in their everyday life. Informal reasoning is concerned with reasoning processes dealing with ill-structured problems that are more reflective of external reality. It is more dependent on background knowledge and experience instead of fixed premises constrained by the problem at hand. There may not be one right solution, and individuals often have to find them amidst conflicting, changing and sometimes missing information. More research is needed for a more informed understanding of how individuals reason informally through their construction and justification of arguments in the context of everyday situations.

Secondly, skilled reasoning and more advanced epistemological beliefs have evidenced a consistent link in formal reasoning research, especially in the domain of scientific reasoning, but this association has to be further investigated within the informal reasoning domain. A more critical epistemology, in which knowledge is understood to be complex, evolving and interrelated, is related to more skilled reasoning. The intrinsic value of argument as a foundation for knowing only becomes obvious when "knowledge is seen as the product of a continuing process of examination, comparison, evaluation, and judgment of different, sometimes competing, explanations and perspectives" (Kuhn, 1991, p.202). Therefore, as much as it is

important to evaluate skills of argumentative reasoning, it is also necessary to examine the implicit cognitive schemas that occur behind these skills. A deeper understanding of the association between implicit epistemological beliefs and explicit reasoning skills gives a clearer insight into components of good, effective and sustained thinking which shape individuals to be inquiring, analytical and critical.

Lastly, and possibly most importantly for the current dissertation, the scarcity of empirically-based research concerning the role of the family, as compared to research in schools, in the fostering of these cognitive skills and beliefs was highlighted in both sets of literature. Family is established as a primary social setting for children's initial cognitive socialization (Sigel, 2002) and parents are for most children the first main agents of socialization. They are the first models of beliefs, strategies and practices that children observe, learn and imitate from. From the parenting literature, it is clear to see that parents' choice of practices and communication strategies in family upbringing have direct and long-lasting impact on children's development in a variety of domains. Authoritative parenting, an overall parenting climate which is characterized by core components of high parental autonomy-support, high responsiveness, moderate structure and low intrusive control, has produced a remarkably consistent picture of the successful socialization of children. Understanding the role that parents play in children's acquisition of reasoning skills and higher-level epistemological beliefs not only expands the parenting literature in child development but more importantly, informs us on the significance of family in the fostering of thinking skills. In doing so, it allows educators and psychologists alike to identify, encourage and ensure appropriate conditions for the flourishing of children's reasoning skills and epistemological beliefs.

5.2 Research Questions

In response to the research problems highlighted above, four research questions for the current work were conceptualized and specific hypotheses informed by previous literature were formulated. The rationales behind the choice of the measures for personal epistemology and the informal reasoning are first explained before the presentation of the four research questions.

Choice of Personal Epistemology Model and Instrument

The literature review on personal epistemology has highlighted the need for integrated models which can combine differing perspectives that may not be exclusive to each other in order a clearer and more coherent understanding of this field and consequently, the development of better measures. Greene et al.'s (2008) Epistemic and Ontological Cognition Development Model (EOCM) incorporates both developmental and multidimensional approaches with underpinnings from philosophy and developmental psychology. It is seen as most suitable for the current work due to a) its integrated theoretical background and relevance to child development literature and b) its quantitative measure based on the theory and the measure's applicability to younger samples.

Firstly, the integrated nature of the EOCM allows the current work to take on both developmental and multidimensional perspectives of personal epistemology to guide research hypotheses and interpretations. The EOCM determines the developmental positions (i.e. realist, skepticist, dogmatic, rationalist) of participants' Epistemic and Ontological Cognition (EOC) as well as the strength of their beliefs in the three individual dimensions (i.e. Simple and Certain knowledge: SC, Personal Justification: PJ, and Justification by Authority: JA). This provides not only an understanding of the relations of overall developmental positions to child outcomes, but also allows for further investigation of separate effects of the three dimensions on the outcome constructs. Secondly, the EOCM's incorporation of domain-specificity (i.e. ill-structured and well-structured) may provide more accurate interpretations of the results found in the current work. Although Greene et al. (2008) formulated ill-structured versus well-structured domains in the sense of academic subjects (e.g. history versus mathematics), informal reasoning concerns ill-defined everyday problems with shifting uncertain premises and thus the development of EOC may be possibly characterized and interpreted under the ill-structured domain. Greene et al. (2008) use age and educational level as covariates for the EOCM. These covariates, which are informed by the developmental literature, provide a glimpse of the progression of individual EOC across the lifespan and may be useful for a prior understanding of where the young participants of the current study may be functioning at. Referring to Table 4-3 which appeared in Chapter 4, the relevant components of the EOCM for this dissertation are highlighted.

Table 4-3. Epistemic and Ontological Cognition Development Model (Taken from Greene et al., 2008)

	Ill-Structured Domains				*Well-Structured Domains*			
Age	*Position*	*SC*	*JA*	*PJ*	*Position*	*SC*	*JA*	*PJ*
4-12	Realism	High	High	High	Realism	High	High	High
12-Early College	Dogmatism	Low	High	Low	Realism	High	High	High
	Skepticism	Low	Low	High				
Mid to Late College	Rationalism	Low	Mid	Mid	Dogmatism	Low	High	Low
					Skepticism	Low	Low	High
Graduate Education	Rationalism	Low	Mid	Mid	Rationalism	Low	Mid	Mid

SC = Simple and Certain Knowledge Dimension; JA = Justification by Authority Dimension; PJ = Personal Justification Dimension

An additional reason for the choice of the EOCM is its accompanying quantitative measure. To validate the EOCM, Greene et al. (2010) developed the Epistemic and Ontological Cognition Questionnaire (EOCQ). The EOCQ is a succinct 13-items questionnaire which is easy to administer to large groups of participants and suitable for children as young as fifth-graders. The items fall under either one of the three EOC dimensions of SC, JA or PJ. On a six-point Likert scale ranging from strongly agrees to strongly disagrees, each dimension is labeled in terms of strong, moderate or weak belief. The profile of the individual's beliefs along the three dimensions will then identify the position an individual is at in the EOCM. Compared to other measures for children such as Kuhn's Epistemological Understanding Questionnaire and Schommer's Epistemological Questionnaire (c.f. Duell and Schommer-Aikins, 2001), the EOCQ allows for both developmental and multidimensional perspectives to be employed rather than just siding with one approach. Kuhn's questionnaire (Kuhn et al., 2000) is interesting with regards to the various broad judgment domains used, namely personal taste, aesthetic taste, value judgment, facts about the social world, and facts about the physical world, but the EOCQ's ill-structured domain seems more relevant for investigating informal reasoning skills as compared to Kuhn's five judgment domains. Thus, due to its ease of use and validated psychometric properties (Greene et al., 2010), coupled with a sound theoretical basis, the EOCQ will be used as the measure of personal epistemological beliefs in the current study.

In the current work, parental EOC beliefs will be measured alongside with the children's so as to gain deeper insights into the associations of the personal

epistemology of parents and the parenting practices they use (i.e. parenting dimensions). Parental beliefs as predictors of children's beliefs will also be tested.

Choice of Reasoning Task

Argument generation and evaluation with complex ill-structured problems form the core of informal reasoning. Empirical work in argumentative reasoning has utilized both verbal and written methods to measure reasoning. Responses are often coded into different components of arguments such as the number of reasons, counterarguments and rebuttals. These various components are then either analyzed in direct relations with other variables (e.g., demographics, cognitive or affect variables) or these components are collapsed into a single score for analyses. However, most of these methods for measuring argumentative reasoning are often time- and labor-intensive. In the current work, the data collection is part of a larger longitudinal project conducted in the German state of North-Rhine Westphalia: "The role of family support from parents for discourse and written competence in lower secondary schools" (Die Rolle Familialer Unterstützung beim Erwerb von Diskurs- und Schreibfähigkeiten in der Sekundarstufe I). Due to the large sample size (29 schools) and the time constraints given by schools for data collection, the measure for argumentative reasoning has to be both time effective and easy to administer. Ill-defined problems characteristic of informal reasoning are often difficult to be succinctly explicated and often involve lengthier argumentation in the process of finding solutions. This adds to the difficulty of finding an appropriate measure.

A solution was found by adapting the methodology of Means and Voss (1996) by using certain components of their reasoning task and developing these components into a pen and paper task. Means and Voss used written story scenarios to illustrate an everyday problem (e.g., bullying). The child participant is asked to place himself/herself in the story and respond as one of its characters. In the original task, the child has to respond what he/she will do in the situation and provide the necessary justifications for his/her arguments. These arguments are then coded into different components of argumentation for analyses. As Means and Voss (1996) provided a useful ranking schema for evaluating the quality of reasons (i.e., from low-level vague reasons to high-level abstract ones), the first adapted task of Reason Evaluation attempts to measure the ability of the child to evaluate reasons of different quality by ranking six given solutions

with their respective reasons in response to a story dilemma that they are asked to read. Additionally, Means and Voss (1996) noted that better arguments tended to be more elaborated as they made higher use of certain structural components of arguments (e.g., metastatements, qualifiers and counterarguments). Thus the second task of Structure Differentiation attempts to measure the child's ability to differentiate between four given arguments which differed in their use of these structural strategies, once again utilizing a ranking method to select and rate given arguments from the best to the worst. These two tasks will be further elaborated on in the Method section.

The next section states the four main research questions of the dissertation. In the context of familial socialization of parenting practices, epistemological beliefs and communication patterns, the first set of questions concerns the fostering of children's reasoning skills, the second concerns the fostering of children's EOC beliefs, the third investigates the relation between the two outcome outcomes and the last set considers the influence of socioeconomic status on the familial and outcome variables. The research questions are as follows:

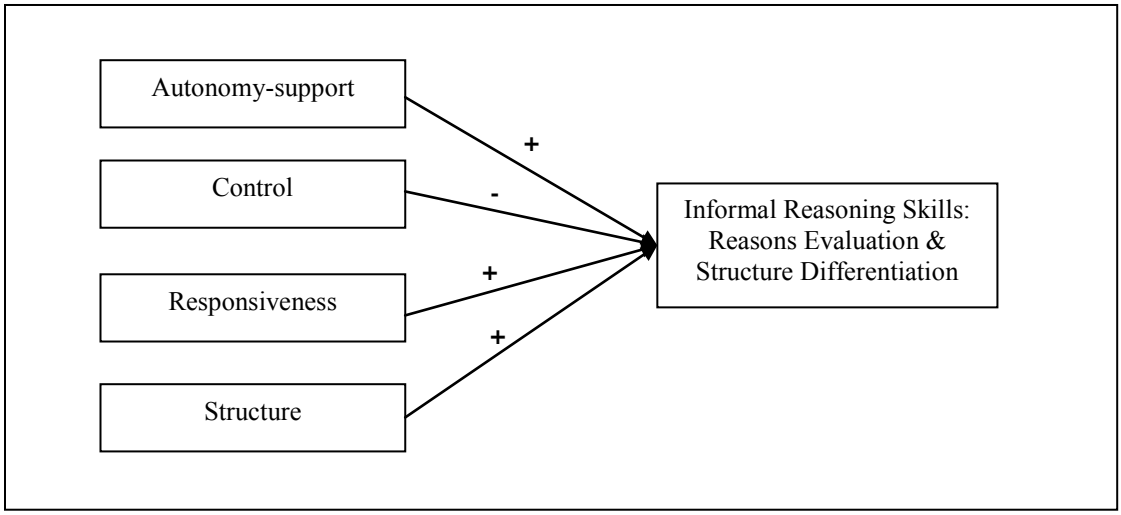
Research Question 1. Do familial variables such as parenting practices and family communication patterns influence children's informal reasoning competence?

1.1 Do parenting practices, in terms of the four dimensions of autonomy-support, control, responsiveness and structure, influence children's informal reasoning skills?

The parenting literature illuminates an established set of dimensions which have often been used as measures of parenting – *autonomy-support*, *control*, *responsiveness* and *structure* (refer to Section 2.3). *Autonomy-support* refers to parents' encouragement of children's self-initiated expression and action and parental provision of choices. In contrast, *control* refers to parental acts which are harsh, intrusive and manipulative with the sole goal of obtaining child compliance while maintaining adult authority. *Responsiveness* refers to parents' dedication of time, attention and resources to their children for maintaining interpersonal connection. *Structure* refers to the setting of clear expectations, rules and limits, and the following through of appropriate consequences when these are not met. The combination of high autonomy-support, responsiveness, appropriate structure and low control is similar to the style of authoritative parenting.

Authoritative parenting has been firmly established through many empirical studies to have an association with a variety of positive academic and psychosocial child outcomes (refer to Chapter 2.1).

Figure 5-1. Hypotheses of parenting practices as predictors of children's reasoning skills



Therefore, it is hypothesized that higher informal reasoning skills of children will be fostered by these four parenting dimensions in an authoritative manner – high autonomy-support, responsiveness and structure, and low control. From Figure 5-1, autonomy-support, responsiveness and structure are hypothesized to have positive associations with children's informal reasoning skills while control will have a negative association. Autonomy-supportive parents acknowledge and consider the child's perspectives, opinions and emotions, providing many opportunities for the child's participation in and contribution to family discussions. There is a higher chance that in family decision-making processes and disagreements, the child is exposed to different argumentative strategies, and thus is able to observe and learn higher skills of defending his/her own stance in discussions and to evaluate differing points of view. High responsiveness socializes the child to be more open to his/her parents' suggestions and decisions and for children to view their parents as role models. Responsive parents are more aware of their children's needs and their efforts to meet them provide the child with a secure environment for frequent interactions within the family. The child is more willing to listen to parents' arguments, rationales and explanations as parents are equally willing to take note of the child's need and perspectives. Structure provides the consistent and necessary contingent boundaries for the child to know his/her parents' expectations and when provided in an autonomy-supportive way, allows the child to

have a sense of predictability and a sense of personal efficacy to meet challenges. Faced with new arguments, the child is able to use previously acquired reasoning skills to respond effectively and his/her reasoning competence is also shaped with the guidance of parental feedback.

In contrast, high control interferes with the fostering of reasoning as children's opportunities for open and active participation in family discussions are limited, thus providing less learning opportunities for observations and imitations of argumentative strategies used by more expert adults. Controlling strategies are employed to gain child compliance and family interactions require the child to respect parents' wishes and conform to their views and opinions, with no room for negotiation or argument.

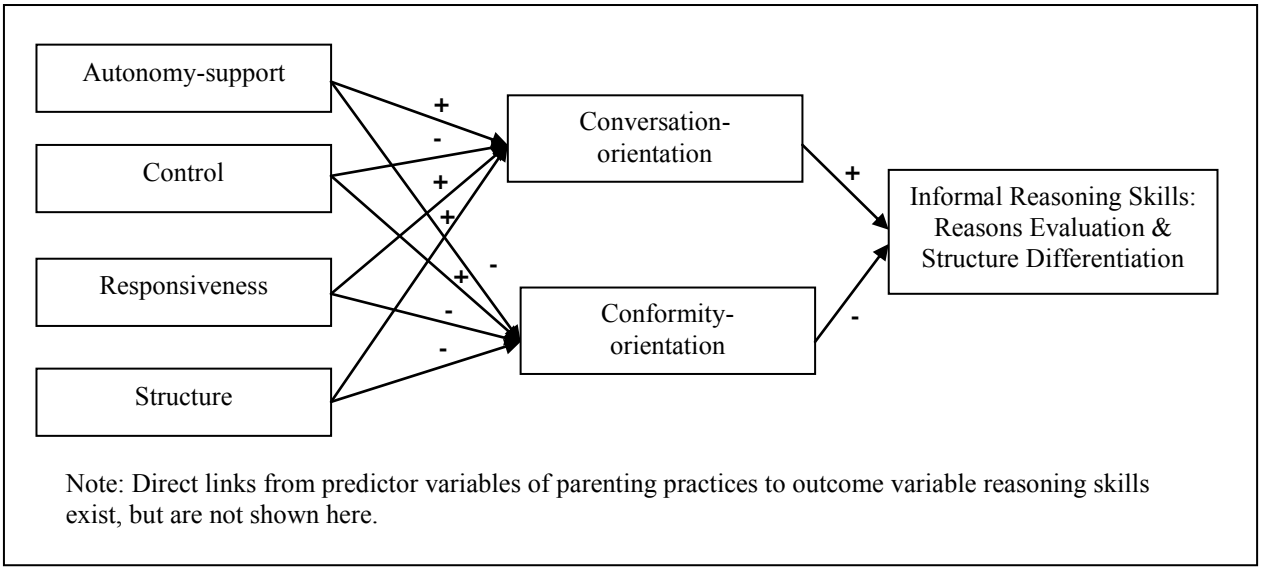
1.2 Do family communication patterns partially mediate the relation between parenting practices and children's informal reasoning skills?

The current work also seeks to investigate if family communication patterns are significant mediators between parenting practices and reasoning skills. A mediating model can help to identify and explicate the mechanism that underlies an observed relationship between the predictor variables, which are parenting dimensions in this case, and the outcome variables of reasoning skills. Parenting practices may have direct influence on reasoning skills but part of this influence may be explained by family communication patterns which have been shown to influence reasoning and problem-solving (c.f. Koerner & Fitzpatrick, 2002). Communication has been regarded as the most instrumental agent of family socialization (Schrodt et al., 2009) and is a defining criteria that distinguishes authoritative from authoritarian parenting: the distinction resting on parents' willingness to listen and to be responsive to their children's needs and views, instead of merely promulgating their own (Baumrind, 1996). Lewis (1981) argued that it is this reciprocal communication characteristic of authoritative parenting that makes the most significant contribution to the positive development of children.

Koerner & Fitzpatrick (2002) found that family communication is characterized by clearly discernable patterns and forms. Families are found to develop and sustain a variety of different communication patterns. They theorized and empirically confirmed two central dimensions of family communication – *conversation-orientation* and *conformity-orientation* – which have been shown to play a significant role in family functioning and form the template for a typology that is capable of predicting and

explaining a number of behavioral and psychosocial outcomes for families. *Conversation-orientation* refers to "the degree to which families create a climate in which all family members are encouraged to participate in unrestrained interaction about a wide array of topics" (Koerner & Fitzpatrick, 2002, p. 85). A high score in this dimension indicates frequent family interactions in which there is active participation of every member in discussions over a wide range of topics including hopes and emotions. Decision-making in the family is a joint family effort. Conversely, a low score indicates a low frequency of family interactions with engagement in a small number of topics and rare exchange of thoughts, hopes or emotions. *Conformity-orientation*, on the other hand, refers to "the degree to which family communication stresses a climate of homogeneity of attitudes, values, and beliefs" (Koerner & Fitzpatrick, 2002, p. 85). A high score in this dimension indicates a focus on the uniformity of beliefs and attitudes within the family, with emphasis placed on obedience and compliance according to the traditional family hierarchy, the avoidance of conflict and the interdependency of family members. Conversely, a low score indicates a focus on heterogeneous attitudes and beliefs within the family, with emphasis on the individuality, independence and equality of each family member in intergenerational discussions.

Figure 5-2. Hypothesized associations of mediation model with family communication patterns



Note: Direct links from predictor variables of parenting practices to outcome variable reasoning skills exist, but are not shown here.

As seen from Figure 5-2, it is hypothesized that parental provisions of autonomy-support, structure and responsiveness are positively associated with conversation-orientation, which is subsequently hypothesized to have a positive association with children's reasoning skills. A family with a high score in conversation-

orientation sees communication as a vital means of educating and socializing children and seeks to provide a highly stimulated environment for the child to give and respond to views on various topics. As members are encouraged to participate in frequent discussions, there are higher chances of children being able to observe and imitate the argumentative reasoning strategies of more expert members, to reflect on the effectiveness of these strategies in arguments, and to practice them in a variety of topics as they filter out higher-level reasoning skills from lower-level ones. In contrast, control is hypothesized to be positively associated with conformity-orientation which has a subsequent negative association with children's reasoning skills. A family with a high score in conformity-orientation emphasizes homogenous values and attitudes and thus gives little space for divergent opinions. Child compliance is gained through focusing on obedience and submission regardless of the soundness of reasons given for the family decisions made. Argument skills such as the discrimination of good and bad reasons and evaluation of supporting evidence and justifications are unlikely to be improved when family discussions do not display logical reasoning or use good arguments.

It is important to note that every family has characteristics of both communication dimensions. The more significant question is the degree to which each family exhibits these characteristics. In the context of Baumrind's work, authoritative parents may require a moderate degree of conformity in order for joint decisions to be reached whereby all members of the family are agreeable to. Authoritarian parents are seen as requiring the most conformity from their children, authoritative parents require less conformity and permissive parents require the least conformity (Koerner & Fitzpatrick, 2002). However in SDT, it can be argued that authoritative parenting may exhibit conformity within the family for a different reason. The homogeneity of beliefs, attitudes and values within the family can also be a result of children having voluntarily internalized their parents' beliefs, attitudes and values, thus resulting in committed compliance, that is, a genuine adoption of parents' agenda which remains the same across situations (cf. Kochanska et al., 2001). These two different perspectives can be clarified by observing the correlations of conformity-orientation and the parenting dimension of control. In the context of Baumrind's work, control should be positively correlated with conformity-orientation but if in the context of SDT, it should not be as its interpretation indicates volitional conformity from children.

Research Question 2. Do familial variables such as parenting practices and parental EOC beliefs influence children's EOC beliefs?

2.1 What are the associations between parental EOC beliefs and parenting practices?

First, the association between parental EOC and the four parenting practices will be investigated in order to gain a deeper knowledge of the relations between parental beliefs and their choice of parenting practices. There have been associations of authoritative parenting with higher-level epistemological beliefs, that is, knowledge as being self-constructed, active and prone to changes (c.f. Ricco & Rodriguez, 2006). From the EOCM, an individual's EOC can be analyzed in two ways: with separate dimensions or/and with developmental positions from the profile of these dimensions.

The relations of the three EOC dimensions of SC, PJ and JA with parenting practices are first analyzed. The dimensions of SC and JA are hypothesized to have negative associations with autonomy-support, structure and responsiveness but a positive association with control. Parents who view knowledge as being concrete and unchanging and justify the credibility of knowledge solely through authority figures often do not recognize the complexity and subjectivity of knowledge. This fixed view of knowledge may cause parents to be more reliant on authoritarian practices through the exercise of intrusive controlling strategies. Parents who understand the complex evolving nature of knowledge and the value of justification are more open and willing to listen to their children's views and arguments, and are thus more contingently responsive to the needs of their children without a need to rely on controlling strategies. They may therefore be more inclined to use autonomy-supportive strategies in their parenting.

However, PJ is hypothesized to be positively associated with autonomy-support, structure and responsiveness but negatively associated with control. Having the understanding that individuals can have different views may help parents to recognize that apart from their views, there are also others that are equally valid. Although the views of children may not always be sensible or appropriate, but parents who see the subjectivity of knowledge may be more aware that different individuals can hold differing perspectives regarding the same matters. This can lead them to use more autonomy-supportive strategies to acknowledge and recognize differing perspectives that their children may have and to dedicate more time and resources to the needs of the

child, in contrast to the use of harsh controlling strategies to silence the individual voices of children to gain compliance.

Lastly, the current work hypothesizes that the higher the EOC developmental position of parents, as indicated by the four positions in the EOCM (i.e. realism, dogmatism, scepticism, rationalism), the more authoritative their parenting practices will be. Higher-level developmental positions will have positive associations with more positive parenting practices of providing autonomy-support, responsiveness and structure. Conversely, higher EOC developmental positions will have a negative association with harsh parental control.

2.2 Do parenting practices and parents' EOC belief dimensions influence children's EOC belief dimensions?

Parents are, as mentioned before, the first role models for children to observe and imitate from. Even though parents may not verbalize or even consciously reflect on their own beliefs, these implicit beliefs of knowledge and knowing can be expressed in parenting practices, parent-child interactions and conflicts and may become internalized via implicit learning processes by the child. The individual belief dimensions of children's EOC (e.g., JA, PJ and SC) will be first considered, followed by the overall developmental positions. The hypotheses are graphically represented in Figure 4-3.

With regards to parenting practices, parental provision of autonomy-support is positively associated to stronger beliefs of children in PJ while weaker beliefs in SC and JA. When parents support the autonomy of a child by considering and encouraging his/her thoughts and opinions, the child realizes that opinions can differ and that each opinion may have their own merits. The constructive nature of knowledge can be observed from the differences in opinions between parent and child on the same matter. Additionally, the provision of rationales and explanations as part of autonomy-support can enable the child to realise that some opinions can be more justified than others, and possibly help him/her to find his/her personal commitments within a relativistic context. Autonomy-support allows children to safely explore differences in perspectives and does not restrict their knowledge views to absolute shades of black or white. The latter viewpoint may be a possible consequence of harsh parental standards which are to be obeyed at all costs.

In contrast, parental use of intrusive control is hypothesized to be associated with stronger beliefs in SC and JA, but weaker beliefs in PJ. When parents use harsh control-oriented methods to obtain immediate compliance, the child is unable to observe that it is acceptable to have varying perspectives. Without the space to question or doubt, knowledge is often passed down as being fixed, certain and unchanging and justifiable only through authority figures. The use of controlling strategies often occurs in authoritarian families who place strong emphasis on the traditional hierarchical family structure. This hierarchical structure may provide the child with the false belief that authority figures are always accurate sources of knowledge.

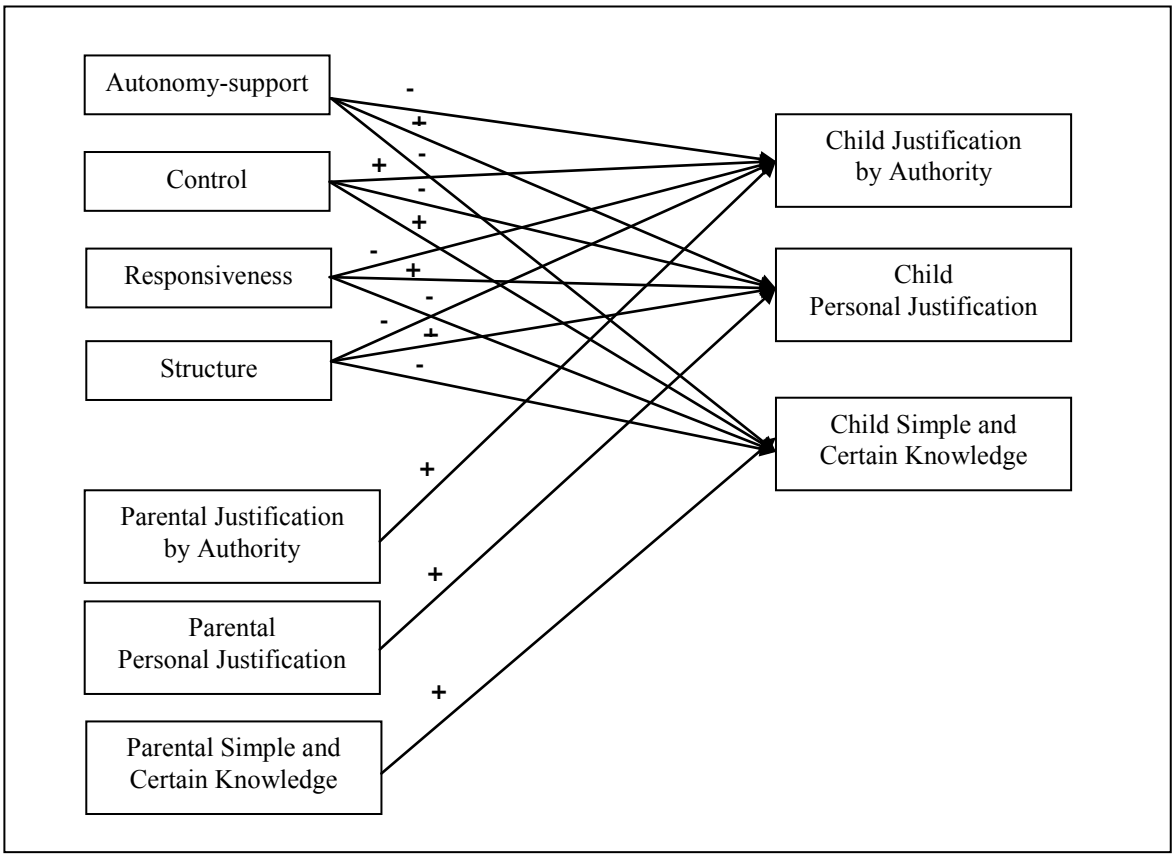
Structure, the consistent provision of clear expectations and guidelines, is hypothesized to be associated with weaker beliefs in SC and JA, but stronger beliefs in PJ. Structure provides children with a sense of predictability and self-efficacy. With a higher sense of agency and self-efficacy, children are more able to understand that they are causal agents and constructors of knowledge, and that the knowledge claims of adults are not always accurate even with their status of authority. Children are made aware of the notion that different individuals can have different beliefs and actions which can contribute to different outcomes. Structure also protects children from too much complexity and gives adequate support to help children realize their own limits and potentials. With growing competence and mastery, the genuine complexity of knowledge is gradually revealed as the child attempts to understand the nature of knowledge and knowing, debunking ideas that knowledge is easily graspable and static.

Responsiveness is hypothesized to be associated with weaker beliefs in SC and JA, but stronger beliefs in PJ. Responsiveness, the dedication of parents' time and resources to the child, ensures that parents are active and involved in their child's life and increases the possibility that parental behaviors are attuned to the child's needs. This parental warmth, acceptance and involvement increases the child's willingness and security to explore his/her environment, to discover the constructive, contextual and evolving nature of knowledge and to have his/her voice heard.

Lastly, parental EOC belief dimensions are also investigated in relations to child EOC belief dimensions. Gerber (2004) found some significant correlations between parent and child epistemological beliefs but these were not in line with theoretical assumptions. Therefore, this current study seeks to investigate if or under what

circumstances intergenerational transmission of beliefs can occur. Although interrelations between these dimensions exist and the transmission of beliefs in one dimension may possibly have influence on another (e.g. JA beliefs has positive relations with SC), only one direct link is postulated from parent to child in each dimension for the parsimony of the model. It is hypothesized that there will be positive transmissions of parental beliefs to children's beliefs within each dimension. For example, stronger beliefs in SC for parents will be associated with stronger beliefs of SC for children, and likewise for the other two dimensions.

Figure 5-3. Hypotheses of parenting practices and parental EOC belief dimensions as predictors of child EOC belief dimensions



2.3 Is there a positive relation between parents' developmental positions and children's developmental positions in the EOCM?

This next part considers the developmental positions of children and their parents in the EOCM, as defined by the four positions of realists, skepticists, dogmatists and rationalists. The individual's developmental position is defined by the profile of his/her beliefs across the three EOC belief dimensions of SC, JA and PJ (see Table 4-3). As postulated in the EOCM, the progression of developmental positions move from the

position of realism where one sees knowledge as objectively knowable and directly reflective of external observations to being more subjective, as reflected in positions of dogmatism or skepticism. As individuals recognize that knowledge can be relative and contextual, they either become more reliant on sources of authority for 'right and accurate' knowledge (i.e. dogmatism) or they justify knowledge claims based on their own personal experiences and perceive that due to the relativity of opinions, no one claim can be better than another (i.e. skepticism). The highest position of rationalism is achieved when one learns to balance means of justification between figures of authority and personal experience, and apply one's own thinking and reasoning in this process. Thus, they come to realize that at times, justification of knowledge claims is warranted by authority figures while at other times, personal experience would suffice. When faced with differing perspectives, individuals can evaluate claims by different means and can choose to make their own personal commitments to the conclusions they arrive at.

It is hypothesized that a positive association will be found between parents' overall developmental positions and children's overall developmental positions. Parents' developmental positions are hypothesized to be a significant predictor of children's developmental positions as parents who have more advanced beliefs are highly likely to demonstrate these beliefs in their interactions with their children. Parents who recognize the fallibility and complexity of knowledge may foster these beliefs in their children through the use of higher-level cognitive socialization efforts and communication. They will not solely base their knowledge on what authorities give but will also find other means to verify them. Hence, their children may be quicker to realize that knowledge is self-constructed and subjective. Parents who hold the highest position of rationalist will understand that amidst differing opinions, one can still make a committed personal stance. Therefore, children are not left to see knowledge as overly complicated and out of their understanding, but are also guided to various means of evaluating and justifying knowledge, as modeled by their parents, and may come to learn these strategies for their own evaluation of knowledge claims.

However, it is noteworthy that although parents may have more advanced developmental positions in the EOCM, they need to be careful to not overburden their children as the insecurity and uncertainty of knowledge and knowing may cause children to retreat back to lower levels of epistemological thinking instead of propelling

them forward to have more advanced epistemological perspectives. Children need appropriate parental support and guidance, and these levels of support are highly likely to change through different developmental stages and age periods in order for them to successfully internalize their parents' beliefs into their own age-appropriate schemas. The degree of successful transmission of parent to child beliefs is thus moderated by the use of appropriate and effective parenting practices.

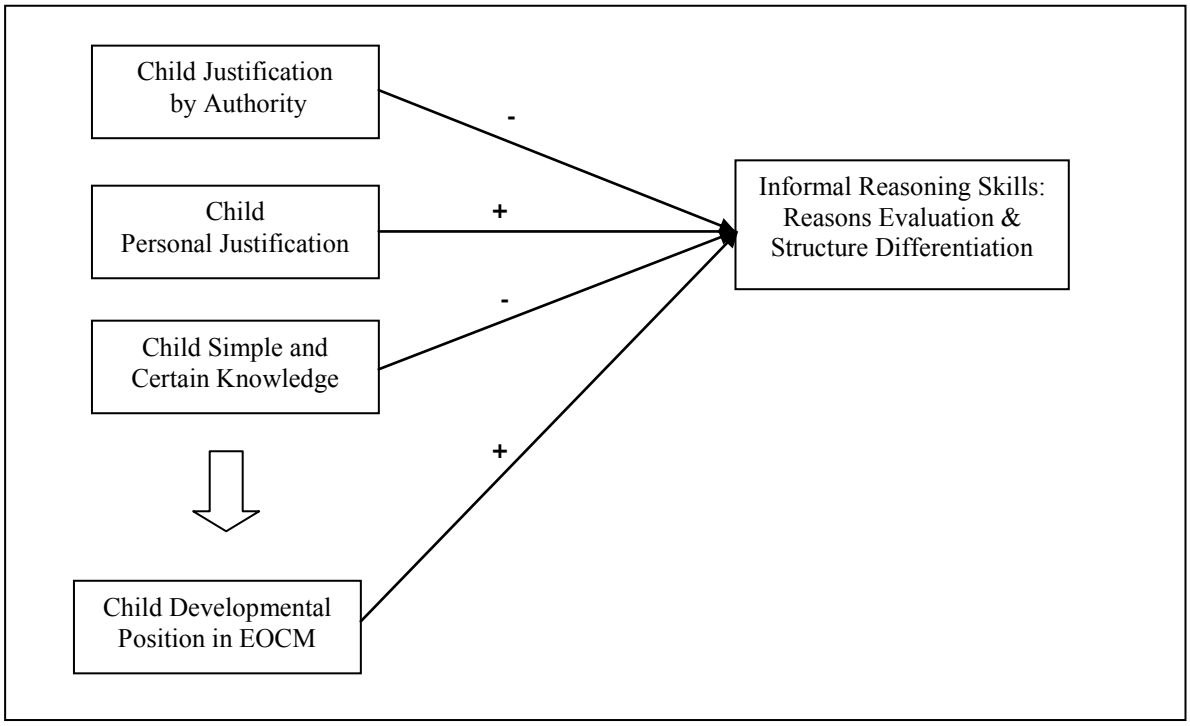
Research Question 3. Are dimensions and developmental positions of children's EOC beliefs significant predictors of their reasoning skills?

Some empirical literature have shown that individuals who hold more sophisticated epistemological understanding are more likely to recognize the need to contemplate and evaluate alternative theories and evidence and see the value of argument in debatable problem material of everyday nature (c.f. Kuhn, 1991; Mason & Scirica, 2006). Reasoning skills can be enhanced or constrained by epistemological beliefs, in which skilled reasoners are more likely to recognize that knowledge is self-constructed, subjective and complex, and thus are more critical when examining arguments.

Informal reasoning in the current dissertation is measured by two tasks: a) Reasons evaluation – participants are asked to rank reasons of arguments from the best quality to the worst, and b) Structure differentiation – participants are asked to rank four arguments which differ in their use of argument components such as qualifiers and counterarguments. As shown in Figure 5-4, it is hypothesized that the EOC belief dimensions of SC and JA will be negatively associated with the reasoning tasks of reasons evaluation and structure differentiation. The more an individual believes that knowledge is simple and certain; made up of fixed, concrete and discrete pieces, the less he/she recognizes the value of critical thinking and reasoning skills are less used and practiced. Similarly, when an individual believes that experts are the ultimate sources of authority is strong, the individual may rarely apply reasoning on knowledge claims given by these sources. In both cases, individuals who have a more concrete view of knowledge as fixed and certain and determined by 'experts' will not realize the value of reasoning in everyday matters and thus their exercise of reasoning skills will be less.

They may therefore be less able to pinpoint good quality reasons from those of poorer quality, and in general to differentiate between better and worse arguments.

Figure 5-4. Hypotheses of child EOC beliefs as predictors of reasoning skills



On the other hand, it is hypothesized that PJ may have a positive relation to reasoning skills. The recognition that knowledge is subjective and that individuals have varying views may increase the individual's willingness to listen to other perspectives instead of having an absolutist mindset of knowledge. The recognition and acknowledgement of subjectivity in knowledge construction is vital and necessary for further epistemic growth. The transition from a realist to a relativistic perspective of knowledge is needed for individuals to progress to higher-level beliefs, whereby after recognizing the relativity of knowledge, individuals can come to realize that even in the midst of relative opinions, some opinions may be more valid than others through means of reason, evaluation and justification. Evidence has to be evaluated in order to arrive at a justified conclusion. However, caution has to be noted regarding this dimension in that too high a belief in PJ can inhibit the developmental trajectory of epistemological thinking and be detrimental to reasoning. When an individual never progresses beyond the notion that knowledge is subjective and relative and thus all opinions are equally valid, he/she never reaches the realization that there are different means to evaluate and

weigh knowledge claims and to draw a valid justified conclusion amongst differing viewpoints.

Additionally, as seen from Figure 5-4, it is hypothesized that higher-level developmental positions of children in the EOCM, as characterized by weaker beliefs in SC and a balance between evaluating and justifying knowledge claims through authority sources and personal experience, are positively associated with more competent evaluative informal reasoning skills, that is, higher competence in evaluating quality reasons and of overall arguments.

Effects of Socioeconomic Status

Lastly, socioeconomic status (SES) has been shown to exert strong influence on parenting and child development (c.f. Bradley & Corwyn, 2002; Jeynes, 2002; Rothman, 2003). Typically measured in terms of education, income and occupational status, it reflects the kinds of capital a family has access to, which is directly connected to their well-being. Three kinds of capital exist: a) financial capital which represents tangible material resources, b) human capital which represents non-tangible resources such as education, and c) social capital which represents resources achieved through social connections.

Each indicator of SES (i.e., education, income and occupational status) has been associated with better parenting (DeGarmo et al., 1999; Parcel & Menaghan, 1990). Families of higher SES have been described as being warmer, more accepting and equitable, while parents of lower SES tend to be more centered on authoritarian parenting practices which are more focused on inculcating obedience and conformity (Hoff-Ginsberg & Tardif, 1995). Additionally, higher SES families have better quality of mother-child interactions: parents engage children in richer conversations with more teaching efforts, read to them more, and elicit more child speech in communication (Shonkoff & Phillips, 2000; Hoff-Ginsberg & Tardif, 1995). Bradley and Corwyn (2001) found that these effects of SES applied to children from infancy through adolescence and generally hold for children from diverse ethnic backgrounds. SES has also been associated with higher cognitive functioning and in the domain of epistemological beliefs, children from low SES families were found to display more naïve beliefs as compared to those from average SES families (Conley et al., 2004).

Differences in parenting practices are strongly implicated in the relation between SES and children's intellectual and academic performance (Hoff-Ginsberg & Tardif, 1995), with SES acting as a proxy variable for factors of intelligence and conceptual understanding. However, one must be careful regarding the categorization of SES family interaction patterns as "good" or "bad" as these relations are complex and the adaptiveness of parent-child interactions can vary across SES contexts (Chen and Berdan, 2006).

Nevertheless, it must be acknowledged that children of high SES families are provided with higher chances of healthy development as their parents have more financial, human and social capital to provide more stimulating and positive environments for their children to develop in. Hence in the current dissertation, SES will be taken into account as a *control factor* within the empirical models consisting of familial variables subjected to statistical analyses.

Additionally, the topic of SES often evokes issues of social justice and equality - while high SES parents are able to provide for their children with a variety of resources, social networks, services and parental actions, a concern remains for low SES children who have limited access to such environments, thus putting them at risk for more developmental problems. SES inequalities stem from varying levels of capabilities and opportunities available to children from different social backgrounds but can more effective parenting help to narrow the effects of differing SES? A meta-analysis of 19 studies on the effectiveness of early intervention programs found that the enhancement of parental skills had a positive relation to cognitive outcomes (Blok et al., 2005, in Kagitcibasi, 2009). In a longitudinal study conducted in Europe with low SES mothers, Kagitcibasi and colleagues (2009) showed that mother training predicted children's school attainment and social adjustment 19 years later. Mother training consisted of building better communication skills and parenting skills. Mothers were taught to encourage and promote their child's cognitive functioning through structured cognitive activities with their child and participation in group discussions with other mothers which covered a range of child developmental topics designed to sensitize the mothers to the needs of their children as well as to their own needs. In addition to having higher school attainment and social adjustment, children of mothers who received parental training also exhibited higher occupational status, and were more likely to own a credit

card which was perceived as a sign of greater integration into modern urban life.

Research Question 4. Can familial variables be significant mediators of the direct relationship of SES on children's reasoning skills and EOC beliefs?

Thus, the current work is also interested to see if familial variables such as parenting practices and family communication patterns can also act as a compensatory mechanism for the direct effects of SES on children's reasoning and EOC beliefs. Can the provisions of more flexible and competent parenting support help to reduce the direct effect of low SES? This is particularly important for low SES groups as familial variables may compensate to help children achieve higher functioning. Mediating models will test if familial variables can be significant mediators in reducing the direct effects of SES on the two child outcomes. Although parental interventions on their own are limited in scope and inadequate to compensate for all missing opportunities derived from SES, it is nevertheless important to investigate their significance in narrowing the gap between different classes. Even if only partial mediation occurs, successful mediation is empirical evidence that familial practices are significant and that parenting interventions should be supported in order to enable parents to become more successful facilitators of their child's development.

5.3 Research Aims

In conclusion, there are two research aims for this dissertation:

1. To formulate theoretical models informed by the current literature
    a. for the fostering of higher informal reasoning skills and higher-level EOC beliefs of children in the familial context of parenting practices, parental epistemological beliefs and family communication patterns,
    b. to investigate if children's EOC beliefs can act as significant predictors of their informal reasoning skills, and
    c. to test if familial variables can be significant mediators of the direct effects of SES on child outcomes.
2. To test these models empirically using path analyses and quantitative data analyses.

CHAPTER 6
RESEARCH METHODOLOGY

6.1 Participants

1994 participants' data were analyzed: 997 fifth-graders (mean age - 10.86; 45.1% girls; 54.8% boys) from 29 secondary schools in the state of North-Rhine Westphalia, Germany, and their respective parents (65.7% mothers, 8.7% fathers, 22.7% who did it together and 0.4% child's other caretaker). Fifth-grade was chosen as it is most commonly a transitional stage from elementary to secondary school. This transition from childhood into adolescence is marked by a trading of dependency on parents for dependency on peers (Steinberg & Silverberg, 1986). Thus as the role of parents is the focus of the current study, fifth-graders were deemed to be most suitable for the sample population as compared to older adolescents.

Germany has a three level secondary school system, consisting of a higher track (Gymnasium), a middle track (Realschule) and a lower track (Hauptschule). SES and school success has consistently shown a strong association with school track, with a disproportionately large number of young people from lower social backgrounds enrolled in the lower track school as compared to other tracks (Rosebrock, 2006). Thus in order to get a socially stratified sample, data was collected from the higher and lower school tracks (69.9% from Gymnasium, 30.1% from Hauptschule).

The parent-child data was matched using unique codes protecting anonymity which consisted of the name initials of both child and parent and the birth date of the child. Only matched data in the project FUnDuS (elaborated in Section 6.3 below), with information from both parents and children, was used in the current dissertation.

6.2 Measures

<u>Parenting Dimensions</u>

A multidimensional conceptualization of parenting was taken from Wild (1999). This was partially adapted from the Children's Perceptions of Parents Scale (Gronick, Ryan & Deci, 1991; Grolnick & Ryan, 1989) and based on four theoretically derived

dimensions of parental involvement from SDT, namely autonomy-support, responsiveness, control and structure. Responses were made on a four-point Likert scale, ranging from 1 (strongly disagree) to 4 (strongly agree). In total, there were 34 items: a) *Autonomy-support* consisted of 11 items, b) *Responsiveness* 6 items, c) *Control* 6 items, and d) *Structure* 11 items (refer to Appendix Scale 1).

a) *Autonomy-Support*

Autonomy-support refers to parental acknowledgement of the child's view, the encouragement of child-initiated activities and the provision of choice. The items are concerned with how decisions are made and discussed at home (e.g. "When we discuss at home about what to do on weekends or vacations, my parents use my suggestion") and the degree of autonomy given by parents for the child to make decisions in various domains (e.g. "My parents encourage me to think about what I want to see on television"). The internal consistency of this scale was measured at α=0.78.

b) *Responsiveness*

Responsiveness refers to the parental provision of time, warmth and emotional support for the needs of their child. Some items are "My parents make time for me when I want to talk to them about something" and "My parents often know what I think and how I feel". The internal consistency of this scale was measured at α=0.81.

c) *Control*

Control refers to the strictness of parents in obtaining child compliance. The items are concerned with the extent to which parents demand conformity from their children (e.g. "My parents want me to obey them immediately") and the consequences when the child refuses (e.g. "When I do not immediately do what my parents say, huge arguments occur"). The internal consistency of this scale was measured at α=0.75.

d) *Structure*

Structure refers to the parent's organization of child environment so as to provide clear and consistent expectations, guidelines and rules. The items are

concerned with children's perception of the clear expectations and guidelines within their family (e.g. "With us, everyone knows who, when and what things to do") and their parents' consistency in applying these rules (e.g. "When my parents do not allow something, they cannot be won over in any way"). The internal consistency of this scale was measured at α=0.67.

Socioeconomic status (SES)

SES was measured using the Comparative Analysis of Social Mobility in Industrial Nations (CASMIN) classification grid, which was designed for international comparisons (Brauns and Steinmann, 1999). It is based upon two primary classification criteria: 1) the differentiation of a hierarchy of educational levels, both in terms of the length of educational experience as well as the required intellectual abilities and corresponding curricular contents, and 2) the differentiation between 'general' and 'vocationally-oriented' education. Parents were asked to provide their educational levels and vocational qualifications (Refer to Appendix 4a). Their education levels were then coded into four levels: a) Incomplete elementary education, b) Elementary school education, c) Secondary school education, and d) Secondary school leaving certificate and Tertiary education. Similarly, their vocational qualifications were also first coded into four levels: a) No vocational qualification, b) Vocational qualification, c) Technical College, and d) University. A CASMIN score for each parent was then calculated based on combinations of their educational level and vocational qualification. This resulted in nine levels of combinations (see Table 6-1).

Table 6-1. CASMIN classification

Levels	Educational and Vocational description	Composition of sample (*N*=997)
1a	Inadequately completed general education	2.2%
1b	General elementary school education	3.1%
1c	General elementary school education with vocational training	10.0%
2a	Secondary school education without vocational training	25.9%
2b	Secondary school education with vocational training	1.5%
2c_gen	Secondary school leaving certificate without vocational training	0.9%
2c_voc	Secondary school leaving certificate with vocational training	19.0%
3a	Lower tertiary education (Technical colleges)	12.0%
3b	Higher tertiary education (University)	23.1%

For individuals familiar with the German school system and its terminologies, please refer to Appendix 4b for the CASMIN classification in the German language. Lastly,

the higher CASMIN score of either the mother or father of each participant was taken as the representative SES of the family.

Generally in the sample of 997 parent participants: 2.2% did not complete elementary education; 13.1% completed general elementary school education; 27.4% completed secondary school education; 19.9% achieved the secondary school leaving certificate (i.e. Arbitur); and 35.1% finished tertiary education.

Epistemic and Ontological Cognition Questionnaire (EOCQ)

The EOCQ is the measure of personal epistemological beliefs. It was formulated by Greene et al. (2010) in a domain-specific context of ill-structured versus well-structured academic subjects, namely in the respective subjects of history and mathematics. In each domain, there are 13 items designed to measure three belief dimensions: Simple and certain knowledge, Justification by authority and Personal justification (Refer to Appendix Scale 2a).

As the current study did not seek to measure EOC in an academic domain but more generally as an overarching set of beliefs, the EOCQ was adapted into a domain-general version (R-EOCQ; refer to Appendix Scale 2b). Additionally, the items had to undergo slight changes for the adult sample of parents as certain items were formulated with regards to an educational setting and individuals who were no longer participating in educational courses may find these items difficult to relate to (Refer to Appendix Scale 2c). For example, whereas an item in the child's R-EOCQ was worded as "If a teacher says something is a fact, I believe it", the parent's version had it as "If I am taught something and my teacher says something is a fact, I believe it". The original three belief dimensions remained unchanged in the R-EOCQ, which consisted similarly of 13 items.

a) *Simple and certain knowledge (SC)*

   This dimension refers to the degree to which an individual sees knowledge as concrete, fixed, separate pieces of information which are static. There are 5 items measuring this dimension (e.g. "What is a fact today will be a fact tomorrow.")

b) *Justification by Authority (JA)*

This dimension refers to the degree to which an individual feels that particular sources are sufficient to warrant a knowledge claim. Individuals who have strong belief in justification by authority would claim to "know" something if an expert, teacher, or other reputable source said it. There are 4 items measuring this dimension (e.g. "If an expert says something is a fact, I believe it.").

c) *Personal Justification (PJ)*

This dimension refers to the degree to which an individual feels that personal experiences or logic are sufficient to warrant a knowledge claim. Individuals who have strong belief in personal justification view knowledge claims as subjective to individual experiences, thus all claims are equally valid. There are 4 items measuring this dimension (e.g. "Everyone's knowledge can be different because there is no one absolutely right answer.").

As the original and revised items were formulated in English language but the sample for the current dissertation consisted of children who had German as first language, the items were translated into German language first through the joint effort of a native English speaker and a native German speaker. Subsequently, the version was then checked by an additional native German speaker. Similar to the original EOCQ, responses were made on a 6-point Likert scale ranging from 1 (strongly disagree) to 6 (strongly agree).

After data collection with the R-EOCQ, separate confirmatory factor analyses (CFA) were carried out on both children and parents' data (N=997 in each sample) to validate the three-factor structure hypothesized by the EOCQ. The three factors were SC, JA and PJ. Results showed that both CFAs did not pass the chi-square test (p<.05) and had large chi-square values indicating that the proposed theoretical dimensions were not confirmed by the empirical data. A possible reason for this failure could be attributed to the wording changes made to the EOCQ to adapt it from a domain-specific into a domain-general instrument. Without domain-specificity, the clarity of some items was diminished and as these items could be interpreted in different ways, the result was that items could load significantly on two factors, instead of one, due to inter-correlations between the three factors. An example was Item 1 "The truth means different things to different people". It was conceptualized under the factor of SC, in

which the notion of 'truth' is complex and uncertain, but it could also reflect the factor of PJ, that is, 'truth' is subjective and self-constructed.

Additionally, despite the translation checks, a mistake was found with the translation of item 2, in which the word "memorize" in English had been changed to the word "know" in the German version ("wissen"). This error occurred in the good intentions of one translator to make the questionnaire more understandable for the German children (as the R-EOCQ items were complex and made more difficult to understand without a subject context) but in doing so, negated the validity of this item as it could no longer act as an accurate measure of belief in the simplicity and certainty of knowledge. As a result, this item was eliminated from all analyses.

As the CFA failed to support the hypothesized three-factor structure of the EOCQ, an exploratory factor analysis (EFA) was carried out to find a solution for structuring the individual's EOC beliefs. 33% (N=332) of both the parent and child samples were taken out to conduct the EFA.

Parent Version:

A principal component analysis (PCA) was conducted on the 12 items with orthogonal rotation (varimax). The Kaiser-Meyer-Olkin measure verified the sampling adequacy for the analysis, KMO=.79 ('good' according to Field, 2009). Bartlett's test of sphericity X^2 (66, N=332) = 836.25, p<.001, indicated that correlations between items were sufficiently large for PCA. The analysis showed that three components had eigenvalues over Kaiser's criterion of 1 and in combination explained 52.97% of the variance. Table 6-2 contains the factor loadings of the items. The clustering of items resembled that of the original three factors of the EOCQ, such that factor 1 represents Justification by authority (JA), factor 2 Personal Justification (PJ), and factor 3 Simple and Certain knowledge (SC). JA replicated the exact items as intended by the R-EOCQ for this dimension (Items 6-9). However, the items formulated for SC and PJ did not load entirely on their own factors but some of SC loaded on PJ and vice versa.

As can be seen from Table 6-2, item 13 revealed low loadings on all three factors. This item made more sense when put in a domain-specific context such as "In history/math, knowledge consists of facts and not of opinions" but when the context was removed, participants might have found it difficult to define "knowledge" and to

differentiate between what constituted "facts" and "opinions". In pure sciences like physics and chemistry, a fact is often an objective and verifiable observation having been subjected to rigorous empirical investigations. However, in social sciences or humanities like history, the case for a fact can be much more complex as the composition of history is inevitably made up of a compilation of subjective accounts and different bias of fact finding. Historical facts can change over time and reflect only the present consensus. Due to its low loading on all three factors, item 13 was eliminated.

Table 6-2. EFA of Parental EOC (*N*=332)

Item	**Factors**		
	JA	PJ	SC
6. If an expert says something is a fact, I have no problem in believing it.	**.69**	.25	.03
7. Things written in textbooks are true.	**.81**	.19	-.03
8. If I am taught something, I do not doubt what I learn.	**.81**	.14	.05
9. If I am taught something and my teacher says something is a fact, I believe it.	**.77**	.26	.12
1. The truth means different things to different people.	-.05	**.63**	-.19
5. Fields of knowledge are so complex that man will never really understand it.	.10	**.63**	.00
10. Everybody's knowledge can be different because there is no one absolutely right answer.	-.09	**.71**	.06
12. What is a fact depends upon a person's opinion.	-.03	**.50**	-.45
3. What is a fact today will be a fact tomorrow.	.20	-.23	**.66**
4. An expert's factual knowledge does not change	.32	.01	**.68**
11. If I believe something is right, no one can prove the contrary.	.08	.11	**.80**
13. Knowledge consists of facts and not opinions.	.40	-.12	-.05
Eigenvalues	2.71	1.68	1.97
% of variance	22.58	13.96	16.44

Note: JA – Justification by Authority, PJ – Personal Justification, SC – Simple and Certain Knowledge

The EFA thus displayed a satisfactory three-factor structure, with items 6-9 loading on JA, items 1, 5, 10 and 12 loading on PJ and items 3, 4 and 11 loading on SC. All factor loadings were .5 and higher.

A CFA was then carried out with the separate sample (*N*=665) excluded from the EFA to check if this three-factor structure was replicated. Mplus 6.0 was used with Maximum Likelihood estimation. The three-factor structure appeared to be a good fit to

the data as seen from the fit indices: χ^2 =75.12, df=38, p<.01, CFI=.98, RMSEA=.04, SRMR=.04 (Refer to Kline, 2011). Table 6-3 provides the standardized parameter estimates of all items. All estimates were significant.

Table 6-3. CFA of Parent EOC (*N*=665)

Factor	α	Items	B	*SE*
Justification by Authority	.85	6	.62	.03
		7	.79	.02
		8	.78	.03
		9	.81	.02
Personal Justification	.42	1	.37	.06
		5	.22	.05
		10	.82	.11
		12	.28	.06
Simple and Certain Knowledge	.65	3	.65	.03
		4	.72	.03
		11	.50	.04

Note: All items loaded significantly on the factors (p<.01).

The internal consistencies (α) of each scale were also calculated. The JA scale had an alpha coefficient of .85 while the SC scale had an alpha of .65. However, the PJ scale evidenced a low alpha coefficient of .42.

Child Version:

Similar to the parent's data, a PCA with orthogonal rotation was first executed. However results showed a four-factor structure. It was difficult though to interpret these four factors as two of these factors only consisted of two items each, thus limiting the interpretations that could be made. It was observed that the R-EOCQ might have been difficult for the children sample aged 10-11 years of age. During testing sessions, children had questions regarding words used in the R-EOCQ and took a slightly longer time to respond in comparison to other questionnaires used. Coupled with difficulty in interpreting a four-factor structure from the PCA, a three-factor structure, similar to the structure of the parent version, was tested. The results of a three factor structure seemed more reliable and interpretable.

The Kaiser-Meyer-Olkin measure verified the sampling adequacy for the analysis, KMO=.696 ('mediocre' according to Field, 2009). Bartlett's test of sphericity χ^2(66, *N*=332) = 441.64, p<.001, indicated that correlations between items were sufficiently large for PCA. The analysis showed that the three-factor structure explained

46.10% of the variance. Table 6-4 contains the factor loadings after rotation. The same dimensions as the parent version can be inferred from the factor loadings – Justification by authority (JA), Personal justification (PJ) and Simple and certain knowledge (SC).

Table 6-4. EFA of Child EOC (*N*=332)

Item	**Factors**		
	JA	PJ	SC
6. If an expert says something is a fact, I have no problem in believing it.	**.53**	-.13	.34
7. Things written in my school books are true.	**.73**	-.14	.15
8. I do not doubt what I learn in class.	**.73**	.29	-.10
9. If my teacher says something is a fact, I believe it.	**.75**	.16	.02
3. What is a fact today will be a fact tomorrow.	.48	.18	-.03
1. The truth means different things to different people.	.20	**.56**	.00
10. Everybody's knowledge can be different because there is no one absolutely right answer.	-.01	**.51**	.35
12. What is a fact depends upon a person's opinion.	.08	**.79**	.08
4. An expert's factual knowledge does not change	.24	-.13	**.70**
5. Fields of knowledge are so complex that man will never really understand it.	.00	.16	**.63**
11. If I believe something is right, no one can prove the contrary.	-.02	.17	**.65**
13. Knowledge consists of facts and not opinions.	-.01	.35	.37
Eigenvalues	2.24	1.57	1.72
% of variance	18.63	13.12	14.35

Note: JA – Justification by Authority, PJ – Personal Justification, SC – Simple and Certain Knowledge

Item 13, similar to the parent version, showed poor loadings on all 3 factors and thus was also eliminated from the child version (reason mentioned in the parent section). Items 6-9 clearly defined the first factor as 'Justification by Authority'. Surprisingly, item 3 also loaded on this factor, though the loading is not considered high (β=.48). Children seemed to perceive item 3 as an indicator of authority, perhaps because adults who are more control-oriented tend to endorse the statement that what is today will be the same tomorrow, therefore leaving no space for questioning or negotiation. However, to keep the factor of JA similar to the parent's version for comparison of this dimension, coupled with the observation that the loading of item 3on this factor was not high, it was removed from the JA factor in subsequent analyses.

The EFA thus displayed a satisfactory three-factor structure, with items 6-9 loading on JA, items 1, 10 and 12 loading on PJ and items 4, 5 and 11 loading on SC. All factor loadings were .5 and higher.

Similar to the parent questionnaire, a CFA was then carried out on the separate sample (*N*=665) to check if this three-factor structure was replicated. Mplus 6.0 was used with Maximum Likelihood estimation. The three-factor structure appeared to be a good fit to the data as seen from the fit indices: χ^2=52.31, df=30, p<.05, CFI=.97, RMSEA=.03, SRMR=.03 (Refer to Kline, 2011). Table 6-5 provides the standardized parameter estimates of all items. All estimates were significant.

Table 6-5. CFA of Child EOC (*N*=665)

Factor	α	Items	B	*SE*
Justification by Authority	.66	6	.47	.04
		7	.51	.05
		8	.63	.04
		9	.62	.04
Personal Justification	.39	1	.37	.06
		10	.42	.06
		12	.46	.06
Simple and Certain Knowledge	.60	4	.66	.05
		5	.51	.05
		11	.57	.05

Note: All items loaded significantly on the factors (p<.01).

The internal consistencies (α) of each scale revealed the JA scale had an alpha coefficient of .66 while the SC scale had an alpha of .60. Once again, similar to the same dimension in Parental EOC beliefs, the PJ scale also evidenced a low alpha coefficient of .39.

Differences in Parent and Child EOC factors:

Overall, the item loadings for the dimension of JA for parents and children included the same items (Item 6-9). This confirmed the validity of this scale as the four items were intentionally constructed to measure JA beliefs in the original R-EOCQ. The internal consistencies for this scale for both samples were also satisfactory.

However, the PJ dimensions showed low internal consistencies for both parent (α=.42) and child (α=.39) questionnaires. Thus, this dimension was deemed as

unreliable and was excluded from later analyses to avoid misinterpretations of results generated by this scale.

For the SC dimension, both scales of parents and children consisted of three items but there was a difference in one item between the parent and children scales (Refer to Table 6-6).

Table 6-6. Simple and Certain Knowledge dimension (Parent and Child version)

Parent Scale	**Child Scale**
3. What is a fact today will be a fact tomorrow.	5. Fields of knowledge are so complex that man will never really understand it.
4. An expert's factual knowledge does not change	4. An expert's factual knowledge does not change
11. If I believe something is right, no one can prove the contrary.	11. If I believe something is right, no one can prove the contrary.

It is interesting to note that in the original conceptualization in EOCQ, both items 3 and 5 were indicators of the factor of SC, that is, Greene et al. (2010) formulated these items to be representative of beliefs in knowledge being concrete, separate pieces of information which are unchanging in nature. Thus, although the EFA results of parents' R-EOCQ revealed that the SC dimension consisted of item 3 while children's SC dimension consisted of item 5, both of these items were indicative of knowledge being simple and certain. For the parent, "What is a fact today will be a fact tomorrow" was interpreted as the fixed unchanging nature of knowledge. Knowledge that had been established today should remain the same in future, thus supporting the certainty of knowledge. While for children, the item "Fields of knowledge are so complex that man will never really understand it" was interpreted to be an inverse measure of knowledge being within man's grasp, that it could be understood, attributing to its nature of being relatively simple. Therefore, the differences in the composition of the SC factor could be due to differences in children's and parent's perceptions which led to different item loadings for SC. However, this could be interpreted as a difference in perception and not that SC was defined differently in each sample. This was confirmed by the significant positive correlation of the SC dimension of parents and children ($r = .26$, $p < .05$). The internal consistencies of the SC dimension for both parent and child questionnaires were also deemed satisfactory for later analyses.

Family Communication Patterns Questionnaire

The Family Communication Patterns Questionnaire took its core concepts from the Revised Family Communication Patterns measure (RFCP; Koerner & Fitzpatrick, 2002). There were two main dimensions:

a) *Conversation-orientation*

This is the degree to which families create a climate in which all family members are encouraged to participate in unrestrained interactions over a wide array of topics. A high score in this dimension indicates frequent family interactions in which there is active participation of every member in discussions across a wide range of issues. Decision-making is seen as a joint family effort. Conversely, a low score indicates a low frequency of family interactions with engagement in a small number of subjects and rare exchanges of thoughts, hopes or emotions.

b) *Conformity-orientation*

This is the degree to which family communication stresses a climate of homogeneity of attitudes, values and beliefs. A high score in this dimension emphasizes uniformity of beliefs and attitudes, with emphasis on obedience and compliance according to the family hierarchy, the avoidance of conflict and the interdependence of family members. Conversely, a low score indicates a focus on heterogeneous attitudes and beliefs within the family, with emphasis on the individuality, independence and equality of each family member in intergenerational discussions.

As the longitudinal project FUnDuS, from which the data of the current dissertation was taken from, was an interdisciplinary project, it used a communication scale adapted from various measures which took into account communicative aspects from both fields of psychology and linguistics. Responses were made on a four-point Likert scale, ranging from 1 (strongly disagree) to 4 (strongly agree). A total of 13 items were identified to be in relation to the RFCP's two dimensions, with conversation-orientation consisting of 9 items, while conformity-orientation had 4 items (Refer to Appendix Scale 3).

Firstly, an EFA was conducted on the selected 13 items to check the factor structure. Similar to the sample group for the EFA of the R-EOCQ, the same 33% of the main sample (*N*=332) was used for this analysis. A principal component analysis (PCA) was conducted with orthogonal rotation (varimax). The Kaiser-Meyer-Olkin measure verified the sampling adequacy for the analysis, KMO=.81 ('great' by Fields, 2009). Bartlett's test of sphericity was X^2 (78) = 1304.77, p<.001. The extraction of 2 components accounted for 47.82% of the variance. Table 6-7 contains the factor loadings after rotation (varimax).

Table 6-7. EFA of Communication Scale

Item	**Factors**	
	Conversation-orientation	Conformity-orientation
1. My parents ask for my opinion before family decisions are made.	**.51**	-.25
2. With us decisions are made after we have spoken about it.	**.54**	-.14
3. I like to speak with my parents about my experiences.	**.72**	.09
4. I can tell my parents almost everything.	**.79**	-.13
5. I frequently tell my parents what I did and experienced in the day.	**.72**	.16
6. My parents justify their opinions in conversations with me.	**.52**	-.24
7. It is easy for me to speak with my parents about what is going on within me.	**.73**	.03
8. It is easy for me to speak with my parents about my feelings.	**.73**	-.09
9. We speak often about emotions in our family.	**.55**	-.08
10. My parents expect that children should not have conflicts with adults.	.03	**.80**
11. My parents expect that children should not enter into discussions with adults.	.07	**.83**
12. When I talk with my parents, I do not like to talk about things that concern me.	-.19	**.53**
13. My parents are not interested in my opinions when it does not agree with theirs.	-.53	**.46**
Eigenvalues	4.18	2.04
% of variance	32.14	15.68
A	.83	.65

As seen from Table 6-7, the loadings of all the items ranged between 0.5 - 0.9, with the exception of item 13 having a loading of .46 on the conformity-orientation component. Despite this, the internal consistency of the conformity-orientation scale

was acceptable at .65, thus item 13 was retained in the scale. For the conversation-orientation scale, the internal consistency was good at .83.

A CFA was then carried out on the separate sample (*N*=665) to check if this two-factor structure was replicated. Mplus 6.0 was used with Maximum Likelihood estimation. The two-factor structure appeared to be a good fit to the data as seen from the fit indices: x^2=62.39, df=51, *p*=.13 (>.05), CFI=1.00, RMSEA=.02, SRMR=.03 (Refer to Kline, 2011). Table 6-8 provides the standardized parameter estimates of all items. All estimates were significant.

Table 6-8. CFA of Communication scale

Factor	Items	β	*SE*
Conversation-orientation	1	.40	.04
	2	.42	.04
	3	.56	.03
	4	.70	.03
	5	.51	.03
	6	.59	.04
	7	.56	.03
	8	.65	.03
	9	.55	.04
Conformity-orientation	10	.38	.05
	11	.35	.04
	12	.71	.06
	13	.59	.06

Note: All items loaded significantly on the factors (*p*<.01).

Informal Reasoning Tasks

The informal reasoning tasks were adapted from the study of Means & Voss (1996) as these tasks had been used with fifth-graders and were deemed appropriate and comprehensible for them. Additionally, these adapted tasks were a time-efficient method of approximating evaluative skills of informal argumentative reasoning using ill-structured problems which were reflective of everyday life. There were two measures of evaluative reasoning competence used: a) Reasons Evaluation, and b) Structure Differentiation.

Before the two reasoning measures were presented, a story scenario was first given to the participants where they were informed about a dilemma faced by two lead characters:

Now imagine the following situation: Marie, a girl from the 5th grade, won a school painting competition. However in reality it was her older sister who did the painting. She tells her classmate Tom at recess that she cheated. Another girl had made a beautiful painting by herself but she only won the second place. Tom wants her to confess everything.

This story scenario was then followed with the instructions and content of the two measures:

a) Reasons Evaluation

This was designed as a measure of the participant's ability to evaluate the quality of reasons. Continuing on with the story above, the character Tom consults with his friends over the dilemma and these friends produce different reasons for why Marie should confess her dishonesty. Six reasons were given to the participant and he/she was asked to rank the reasons from the best to the worst (Refer to Appendix 5a).

Table 6-9. Ranking of Reasons (Means & Voss, 1996)

Ranking of reasons	Description
1. Abstract	Logical in form in which a reason is classified as a member of a general or similar class and the participant reasons from this class
2. Consequential	Statements in which a direct consequence is always stated as an outcome of a particular action.
3. Rule-based	Generally accepted beliefs or truisms
4. Authority	Involve appeal to an authority
5. Personal	Based on personal experience
6. Vague	Imprecise statements

*Quality of reason is presumed to decrease over the categories in order of category presentation, although rule-based, authority, and personal reasons are presumed to differ little in quality

According to Means and Voss (1996), reasons in arguments can be classified based on their quality. Table 6-9 shows this classification of quality of reasons into 6 levels. Participants were thus evaluated on their ability to identify which reasons were better or worse based on the rankings they give to each reason.

b) Structure Differentiation

The second task was a measure of the participant's ability to analyze arguments which differed in structural components. Using the same story, Marie now confesses to the teacher about this matter and a class assignment is set by the teacher in the form of a letter-writing activity, which instructs students to write a letter to Marie under the circumstances that she had not confessed. Four arguments, represented by the written letters of four students, were then given to participants. The arguments were different in terms of use of higher-level components of argumentative structure, that is, the use of qualifiers and metastatements ("if/it depends/maybe") and counterarguments ("but"). Means and Voss (1996) found that children with higher informal reasoning skills demonstrated a more elaborated argument structure that made greater use of qualifiers, metastatements and counterarguments. Participants were asked to analyze the quality of the four arguments given and to rank them from the best to the worst (Refer to Appendix 5b).

6.3 Procedure

Data was collected as part of an interdisciplinary longitudinal 3-years project entitled "The role of familial support from parents for discourse and written competence in lower secondary schools" (Die Rolle Familialer Unterstützung beim Erwerb von Diskurs- und Schreibfähigkeiten in der Sekundarstufe I - FUnDuS) by Professor Elke Wild from Bielefeld University and Professor Uta Quasthoff from Dortmund University, funded by the German Federal Ministry of Education and Research (BMBF). Schools in North-Rhine Westphalia were contacted for consent of participation in January-March 2010. When school consent was obtained, parent consent forms were distributed to the schools before the testing sessions in order for parents to be informed about the project and for them to give consent for their children's participation. At the beginning of each testing session, students were to hand in their parent consent forms and those who had signed consent participated in the study. For those whose parents did not give approval or did not wish to participate, they were led to a different room supervised by a teacher and provided with an activity during the test session: colouring of age-appropriate pictures.

Data was collected from March - April 2010. For each testing session, there were two instructors at minimum, with one acting as the lead instructor and the other as an assistant in case of questions. There was a prepared script with standardized instructions for the lead instructor to follow at each testing session. At the start of each session, the code box which consisted of the name initials of the child and his/her parent (both mother and father) and his/her date of birth were explained. These unique codes were important for the later identification of parent-child dyads, while ensuring anonymity of participants. All instructions, items and their respective options on the questionnaires were verbally read out by the lead instructor. This ensured that participants were not disadvantaged by reading ability. Children were then given some time to answer each question after it was read out. Each testing session lasted on average slightly more than an hour, with a five minutes break in between.

For data collected from the parents, children were asked to bring home an envelope of questionnaires and written instructions after the testing sessions held at their schools. After parents had completed these questionnaires, they had to send these questionnaires via post back to Bielefeld University. For every returned questionnaire, the parent-child dyad was rewarded with a choice of a 15-Euros voucher from either of two retailers - Amazon or Media Markt.

CHAPTER 7
RESULTS

7.1 Preliminary Analyses

Preliminary analyses were conducted using the program SPSS. 33% (*N*=332) of both parent and child samples (*N*=997 each) were taken out to conduct EFA of the scales, thus the remaining 67% of both samples (*N*=665) were used for the remaining main analyses.

In order to get a first overview of the data, descriptive statistics consisting of the means, standard deviations and correlations of the twelve variables were examined. Table 7-1 provides this information, and the internal consistencies for each variable measured through questionnaire items.

With regards to the four parenting dimensions of Autonomy-support, Responsiveness, Structure and Control, all dimensions correlated significantly with each other except for the relation between Autonomy-support and Structure (r=.03, p>.05). The highest correlation existed between Autonomy-support and Responsiveness (r=.57, p<.01), demonstrating that the more parents provided autonomy, the more responsive they were towards their children. Autonomy-support and Responsiveness were, however, negatively correlated with Control (r=-.26, p<.01, and r= -.38, p<.01, respectively) but Structure showed a positive relation with Control (r=.11, p<.01).

The four dimensions of parenting also showed significant correlations with the family communication patterns of Communication-orientation and Conformity orientation, with the only non-significant exception being the correlation between Structure and Conformity-orientation (r=-.01, p>.05). Autonomy-support, Responsiveness and Structure showed positive correlations (r=.58, p<.01, r= .63, p<.01 and r=.15, p<.05 respectively) with Conversation-orientation while Control had a negative correlation (r=-.32, p<.01). In contrast, Autonomy-support and Responsiveness had negative correlations (r=-.37, p<.01 and r= -.39, p<.01 respectively) with Conformity-orientation while Control had a moderate positive correlation (r=.57, p<.01).

Table 7-1.
Scale means, standard deviations, reliabilities, and intercorrelations of all variables

	α	Mean (SD)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
SES (1)	-	5.07 (2.40)	1											
Autonomy-support (2)	.78	3.10 (.50)	.10*	1										
Responsiveness (3)	.81	3.43 (.56)	.09*	.57**	1									
Structure (4)	.67	2.51 (.45)	.09*	.03	.09*	1								
Control (5)	.75	2.28 (.69)	-.22**	-.26**	-.38**	.11**	1							
Conversation-orientation (6)	.83	2.81 (.53)	.07	.58**	.63**	.15*	-.32**	1						
Conformity-orientation (7)	.65	2.22 (.63)	-.28**	-.37**	-.39**	-.01	.57**	-.40**	1					
Child Justification by authority (8)	.66	4.41 (.97)	-.01	.18**	.22**	.08*	.00	.22**	.03	1				
Child Simple and certain knowledge (9)	.60	2.51 (.92)	-.23**	.-.10*	-.07	-.02	.34**	-.08	.34**	.21**	1			
Parent Justification by authority (10)	.85	3.78 (.91)	-.28**	.00	-.01	-.08*	.11**	-.01	.16**	.15**	.14**	1		
Parent Simple and certain knowledge (11)	.65	3.27 (1.03)	-.35**	-.10*	-.09*	-.05	.18**	-.08	.26**	.10*	.24**	.54**	1	
Reasons Evaluation Task (12)	-	13.33 (3.55)	.17**	.10*	.05	.06	-.09*	.09*	-.15**	-.01	-.23**	-.13**	-.16**	1
Structure Differentiation Task (13)	-	6.68 (2.31)	.10**	.06	.02	.07	.05	.01	-.01	-.09*	-.11*	-.02	-.07	.20**

*p<.05, **p<.01

With regards to the EOC belief dimensions of SC, JA and PJ of parents and children, significant correlations were seen between the two dimensions at both parent and child levels. Child SC belief was positively correlated to Child JA belief (r=.21, p<.01). Similarly, Parent SC belief was positively correlated to Parent JA belief (r=.54, p<.01). Thus, the more the individual believed that knowledge was simple and certain, the more he/she also believed that authority figures were reliable sources which could act as sufficient justification for knowledge.

Additionally, correlations remained significant and positive across the parent and child levels. Child SC belief was positively correlated with Parent SC belief (r=.24, p<.01) and Parent JA (r=.14, p<.01), and Child JA was positively correlated with Parent SC (r=.10, p<.05) and with Parent JA (r=.15, p<.01). Thus, the stronger parental beliefs were in JA and SC, the stronger children beliefs in JA and SC were too.

With regards to the reasoning skills, the two reasoning tasks evidenced a significant correlation (r=.20, p<.01). Therefore, the more able children were in successfully evaluating the quality of reasons in the first task, the more able they were too in the second reasoning task with regards to differentiating better arguments from poorer ones.

Additionally, an independent t-test was carried out to analyze if participants from the higher track secondary schools (i.e. Gymnasium) performed better than participants from lower track schools (i.e. Hauptschule) in the measures of reasoning skills and EOC belief dimensions.

From Table 7-2, concerning children's skills in reasons evaluation, participants from higher track schools on average showed higher competence as compared to participants from lower track schools. This difference was significant t (657) = -9.09, p<.01. For skills in the structure differentiation task, participants from higher track schools also demonstrated higher competence as compared to participants from lower track schools. This difference was significant t (655) = -4.96, p<.01. For the EOC belief dimensions, higher track participants showed weaker beliefs in SC than lower track participants. This difference was significant t (595) = 9.73, p<.01. However, the difference between the means in JA beliefs of higher track participants and lower track participants was not significant t (603) = .65, p>.05. Therefore in general, participants

from higher track schools performed significantly better than those from the lower track, evidencing higher skills in both reasoning tasks and more advanced EOC through weaker belief in SC.

Table 7-2. School Type on Children's reasoning skills and EOC belief dimensions

	School Type	*N*	*Mean*	*SD*
Reasons Evaluation	Lower track	198	11.52	3.26
	Higher Track	461	14.11	3.39
Structure Differentiation	Lower track	198	6.01	2.25
	Higher track	459	6.96	2.28
Child Simple and Certain Knowledge	Lower track	169	3.06	.94
	Higher track	428	2.30	.82
Child Justification by Authority	Lower track	174	4.46	1.07
	Higher track	431	4.40	.93

Note: Lower Track School – Hauptschule, Higher Track School - Gymnasium

Lastly, to compare the parenting practices of different SES groups, participants were split into three classes based on the CASMIN classification (see Table 7-3). The low SES class consisted of parents who have only the completion of general elementary education. The middle SES class consisted of parents who have completed intermediate general education up to the level of receiving the general maturity certificate which enables one to enter into higher education. The high SES class consisted of those who have completed lower and higher tertiary education. 18 cases were missing.

Table 7-3. Classification of low, middle and high SES classes of parents

SES	Educational and Vocational description	N	Percentage of sample
Low	Inadequately completed general education	99	14.9
	General elementary education General elementary education with vocational training		
Middle	Intermediate general education without vocational training Intermediate general education with vocational training General maturity certificate without vocational training General maturity certificate with vocational training	333	50.1
High	Lower tertiary education (Technical colleges) Higher tertiary education (University)	215	32.3

The means of familial variables, consisting of parenting practices and family communication patterns, of each SES group are given in Table 7-4. For positive parenting practices such as Autonomy-support, Structure and Responsiveness, there was

an increasing trend from low to high SES classes. However for the use of Control, low SES parents evidenced the highest mean followed by a decreasing trend with increasing SES. For family communication patterns, there was an increasing tendency for Conversation-orientation and a decreasing tendency for Conformity-orientation with increasing SES. High SES parents on average had higher scores in Conversation-orientation and lower scores in Conformity-orientation.

Table 7-4. Means of familial variables in low, middle and high SES classes

		Autonomy -support	Control	Structure	Responsiveness	Conversation-orientation	Conformity -orientation
Low SES	Mean	3.01	2.56	2.42	3.39	2.69	2.57
	SD	.49	.77	.45	.62	.54	.55
Middle SES	Mean	3.09	2.32	2.53	3.42	2.81	2.24
	SD	.50	.67	.46	.54	.53	.60
High SES	Mean	3.15	2.11	2.52	3.48	2.84	2.02
	SD	.50	.64	.42	.55	.52	.63

One-way ANOVAs were then conducted to compare if the means of each familial variable were significantly different from each other across the three SES classes. No significant effects of SES between the three classes were found for Autonomy-support, $F(2, 586)= 2.46$, $p>.05$, for Structure, $F(2, 633)= 2.49$, $p>.05$, for Responsiveness, $F(2, 636)= 1.14$, $p>.05$, and for Conversation-orientation, $F(2, 563)= 2.56$, $p>.05$. However, the use of Control differed significantly across the three SES classes, $F(2, 641)= 15.69$, $p<.01$. Conformity-orientation also differed significantly across the three SES classes, $F(2, 609)= 26.52$, $p<.01$.

7.2 Path Analyses on Structural Models

In accordance to the four broad research questions, path analyses were conducted to test the structural models pertaining to these questions. Path analysis was suitable as it allows the simultaneous study of direct and indirect effects with multiple independent and dependent variables (Stage, Carter & Nora, 2004). The analyses were performed using the program Mplus 6.0. Missing data was treated as completely missing at random, and full information likelihood estimation (FIML) was used. There are many benefits to utilizing FIML rather than casewise deletions, listwise deletion, or mean imputation, including more accurate and efficient estimates of parameters than other methods and the advantage of being able to include cases with partial missing data in the analysis (c.f. Enders & Bandalos, 2001).

There are four sets of results pertaining to the four main research questions. The first set of results reports the analyses of the structural models related to children's reasoning skills with regards to parenting practices and family communication patterns. The second set of results reports the analyses of the structural models related to the EOC beliefs of both parents and children. In this section, the relations between parental dimensional and developmental EOC beliefs and the four parenting practices are first investigated. Next, parental EOC belief dimensions and parenting practices are analyzed as predictors of children's EOC belief dimensions. The relations between parents and children's developmental positions in the EOCM are also examined via correlation and regression analyses. As previous empirical literature has established an association between familial variables and SES, SES was used as a control variable in all structural models in the first two sets of results. The third set of results reports the analyses concerning the testing of children's EOC dimensional beliefs as predictors of their reasoning skills. In a separate regression analysis, children's developmental positions in the EOCM are also tested as a predictor of reasoning skills. Lastly, the fourth set of results reports the analyses of mediating models tested to see if familial variables can significantly mediate the strength of the direct effects of SES on the two child outcomes.

In assessing the structural models, a review of goodness-of-fit indices can be found in Kline (2011). These indices provide an indication of how well a sample data fit the a priori model. The Chi-square value (χ^2) is a measure of evaluating overall model fit, and assesses the magnitude of discrepancy between the sample and fitted covariance matrices. A good model fit would provide an insignificant result at a .05 threshold. However, it is important to note that the chi-square statistic has been found to be sensitive to sample size, often rejecting models when large samples are used. The normed chi-square (χ^2/df) is also used to measure model fit. Recommendations for an acceptable normed chi-square ration range from as high as ≤ 5.0 to as low as ≤ 2.0 (Hooper, Coughlan & Mullen, 2008). The Root Mean Square Error of Approximation (RMSEA) is another fit statistic which tells how well the model, with unknown but optimally chosen parameter estimates, would fit the population's covariance matrix. It favors parsimony in that it will choose the model with the lesser number of parameters. An RMSEA score of $<.05$ indicates a good fit and $.05 \leq .RMSEA \leq .08$ indicates an acceptable fit. A confidence interval can also be calculated. The Standardized Root Mean square Residual (SRMR) is another absolute fit statistic which is the square root

of the difference between the residuals of the sample covariance matrix and the hypothesized covariance model. A SRMR of 0 indicates a perfect fit and the cutoff score is also at .05. Additional to the above-mentioned absolute fit indices, an incremental fit statistic will also be used. The Comparative Fit Index (CFI) compares the sample covariance matrix with the null model and simultaneously takes into account sample size. A value of >.95 is presently recognized as indicative of good fit and .90<.CFI≤.95 indicates an acceptable fit. These four goodness-of-fit statistics will be used to evaluate the following structural models.

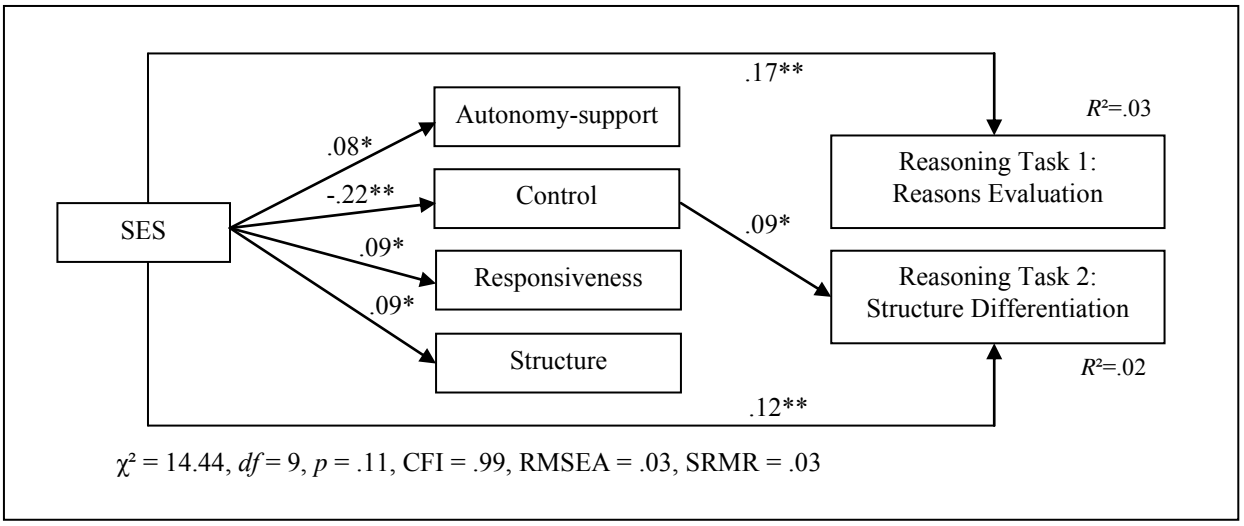
Lastly, a brief mention is necessary regarding the sample size needed for path analysis. Path analysis holds the same assumptions as regression analysis. The accuracy and stability of path analysis decreases with decreasing sample size as well as with an increasing number of variables. The recommended ratio is 20 cases per parameter (or variable measured) in the model (Stage, Carter & Nora, 2004). There are seven structural models which will be evaluated in this chapter. The largest model (see Figure 7-4) consists of 9 variables, which requires a total of 180 participants. The current study has 665 child participants and their respective parents (Total *N*=1330), thus the sample size is more than sufficient for the following path analyses.

Research Question 1. Do familial variables such as parenting practices and family communication patterns influence children's informal reasoning competence?

1.1 Do parenting practices, in terms of the four dimensions of Autonomy-support, Control, Responsiveness and Structure, influence children's informal reasoning skills?

Figure 7-1 shows the significant parameters of the analysis conducted on the structural model postulating that the four parenting dimensions of Autonomy-support, Control, Responsiveness and Structure had direct effects on the two reasoning tasks. SES is controlled for in this model.

Figure 7-1. Structural model of parenting dimensions on children's reasoning skills



Note: SES is a control variable in the structural model. *p<.05, **p<.01

Fit indices were found to be good (χ^2 = 14.44, df = 9, p = .11, CFI = .99, RMSEA = .03, SRMR = .03), demonstrating that the empirical data had a good fit to the theoretical model. When SES was controlled for, only one significant parameter was observed. The parenting dimension of Control was found to have a direct effect on the reasoning task of Structure differentiation (β=.09, p<.05). The effect size was positive, but very small.

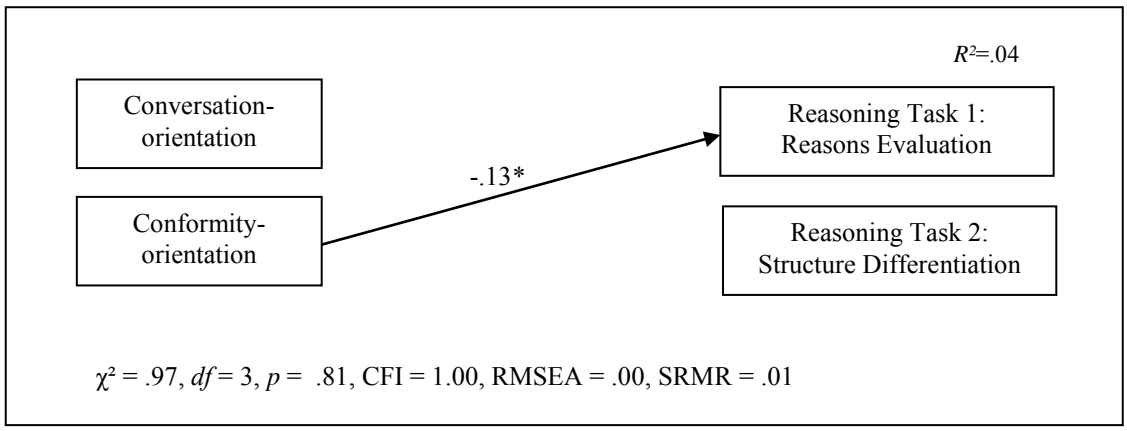
When the structural model was tested without SES as a control variable, the dimension of Control initially showed a significant but negative effect on the reasoning task of Reasons Evaluation (β=-.12, p<.05) but had no significant effect on the Structure Differentiation task. Control showed a different direct effect in structural models with and without SES. When SES was included in the analysis, SES accounted for the variance of the effect of Control on Reasons Evaluation but it exerted an indirect effect through Control on the reasoning task of Structure differentiation. Due to SES' significant role in prompting a direct significant effect from Control to Structure differentiation skills, its relations to the different variables have also been shown in Figure 7-1.

Although parenting dimensions in the structural model (see Figure 7-1) seemingly do not have any significant influence on children's Reasons Evaluation skills, correlation analyses (see Table 7-1) showed two significant links for the task of Reasons Evaluation. Autonomy-support had a positive relation (r= .10, p<.05) while Control had a negative relation (r= -.09, p<.05) with this reasoning skill.

1.2 Do family communication patterns partially mediate the relation between parenting practices and children's informal reasoning skills?

As only the parenting dimension of Control was found to exert a direct effect on child's reasoning skills, and this effect is low, the mediating model involving family communication patterns was no longer applicable as a mediating model is only successful when independent variables first have a significant direct effect on the dependent variables. In light of these results, a simpler structural model was formulated to investigate the direct influence of the two dimensions of family communication patterns – Conversation-orientation and Conformity-orientation, on children's reasoning skills (see Figure 7-2).

Figure 7-2. Structural model of family communication patterns on children's reasoning skills



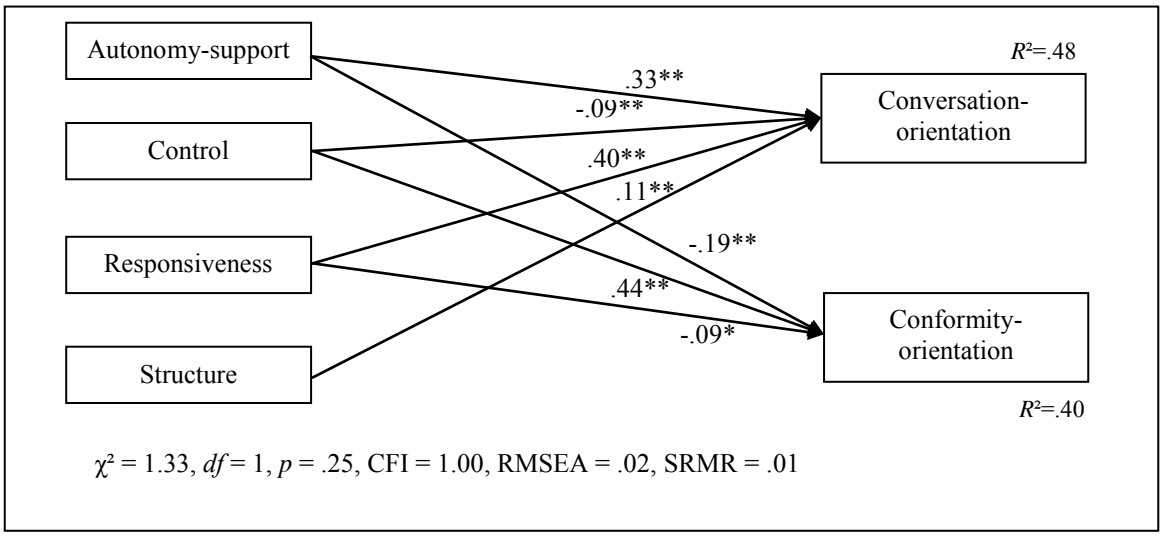
Note: SES is controlled for in the structural model. *p<.05

Fit indices were found to be good (χ^2 = .97, *df* = 3, *p* = .81, CFI = 1.00, RMSEA = .00, SRMR = .01). There was only one significant link demonstrating a negative direct effect of Conformity-orientation on the Reasons Evaluation task (β= -.13, p<.05). Thus, the higher the family scored in conformity-orientation, that is, the emphasis on homogeneity of attitudes, values and attitudes in the family, the less able the child was in evaluating quality of reasons.

Additionally, it was hypothesized that dimensions of parenting would be significant predictors of family communication patterns. Preliminary analyses had already revealed that many significant correlations existed between the parenting dimensions and family communication patterns, and these correlations were in the expected directions. A separate structural model was analyzed regarding the effects of

the four parenting dimensions on family communication patterns. Figure 7-3 shows the results of this structural model.

Figure 7-3. Structural model of parenting dimensions on family communication patterns



Note: SES is controlled for in the structural model. *p<.05, **p<.01

Autonomy-support, Responsiveness and Structure were significant predictors with a direct positive effect on Conversation-orientation (β= .33, p<.01, β= .40, p<.01 and β= .11, p<.01 respectively), while Control had a direct negative effect (β= -.09, p<.01). Thus, parents who provided more autonomy-support, who were more responsive to child's needs, who had clear expectations and guidelines communicated to the child, and who used less intrusive methods of control, were more able to foster a conversation-oriented communication pattern in the family, as characterized by a high frequency of open discussions over a wide range of topics. On the other hand, Autonomy-support and Responsiveness were found to have a direct negative effect on Conformity-orientation (β= -.19, p<.01 and β= -.09, p<.05 respectively), while Control had a positive effect (β= .44, p<.01). Thus, parents who provided less autonomy-support and responsiveness and who used more controlling parenting strategies fostered a more conformity-oriented communication climate within the family.

Table 7-5 provides the unstandardized and standardized estimates, standard deviations and variances of significant parameters from structural models in Figures 7-1, 7-2 and 7-3. According to Stage, Carter and Nora (2004), unstandardized estimates should be reported in path analyses studies as researchers can better compare previously calculated effect sizes between various studies. Standardized coefficients are sample-

specific but unstandardized coefficients can be used to compare models across different samples.

Table 7-5. Decomposition of significant effects from Structural Models in Figures 7-1, 7-2 and 7-3

Structural Model	Effect	Unstandardized coefficient	*SE*	Standardized coefficient	*SE*	R^2
Figure 7-1	Control on Structure Differentiation	0.29	0.13	0.09	0.04	0.02
Figure 7-2	Conformity orientation on Reasons Evaluation	-0.72	0.23	-0.13	0.04	0.04
Figure 7-3	Autonomy-support on Conversation-orientation	0.34	0.04	0.33	0.04	0.48
	Control on Conversation-orientation	-0.07	0.03	-0.09	0.03	
	Responsiveness on Conversation-orientation	0.38	0.04	0.40	0.04	
	Structure on Conversation-orientation	0.13	0.04	0.11	0.03	
	Autonomy-support on Conformity-orientation	-0.24	0.05	-0.19	0.04	0.40
	Control on Conformity-orientation	0.40	0.03	0.44	0.03	
	Responsiveness on Conformity orientation	-0.10	0.05	-0.09	0.04	

Research Question 2. Do familial variables such as parenting practices and parental EOC beliefs influence children's EOC beliefs?

2.1 What are the associations between parental EOC beliefs and parenting practices?

In the EOCM model, the EOC beliefs of individuals can be analyzed in two ways: in terms of particular dimensions and also in terms of developmental positions formulated from the profile across these dimensions. Firstly, parental EOC beliefs in the dimensions of JA and SC were examined in relations to the four dimensions of parenting practices, namely Autonomy-support, Control, Structure and Responsiveness.

For the dimension of parental JA, correlation analyses (see Table 7-1) showed that Structure and Control were significantly associated with this dimension. Structure was found to correlate negatively (r=-.08, p<.05) with JA, which indicated that parents who justified knowledge less by authority figures tended to provide clearer and consistent structure in their parenting practices. Control, in contrast, showed a positive correlation (r= .11, p<.01) with JA. Parents who had stronger beliefs in justifying

knowledge by authorities tended to use more strict and intrusive parenting strategies of control.

For the dimension of parental SC, correlation analyses showed that the parenting dimensions of Autonomy-support, Responsiveness and Control were significantly associated with this dimension. Autonomy-support and Responsiveness demonstrated negative correlations (r = -.10, p<.05 and r = -.09, p<.05 respectively) with SC, indicating that the more parents provided autonomy support and the more they were contingently responsive to the needs of their child, the less they were inclined to believe that knowledge was simple and certain in nature. In contrast, Control had a positive correlation (r= .18, p<.01) with SC. Thus, the stronger parents' belief in SC was, the more they tended to use strict intrusive control in their parenting practices.

Additionally, the developmental EOC positions of parents were determined by their profile across the two dimensions of JA and SC. Originally in the EOCM, these positions were differentiated by three dimensions, but in the current work, the dimension of Personal Justification was not included for analyses due to the scale displaying low internal consistency. However, with reference to Table 7-6, the developmental positions of realism, dogmatism, skepticism and rationalism can be differentiated in the ill-structured domain by just using the two dimensions of JA and SC.

Table 7-6. EOCM in Ill-structured Domains (Greene et al., 2008)

Ill-Structured Domains			
Position	*SC*	*JA*	*PJ*
Realism	High	High	High
Dogmatism	Low	High	Low
Skepticism	Low	Low	High
Rationalism	Low	Mid	Mid

SC = Simple and Certain Knowledge Dimension; JA = Justification by Authority Dimension; PJ = Personal Justification Dimension

Thus, parents' developmental positions were determined from their responses regarding the strength of beliefs in JA and SC. Parental beliefs in JA and SC were first coded into low, mid and high. Subsequently, if a parent had high scores in both dimensions, he/she was coded as a realist. A dogmatist had a low score in SC and a high

score in JA, a skepticist had a low score in both SC and JA and a rationalist had a low score in SC and a mid score in JA.

A total of 201 parents was found to fit into one of the four positions in the EOCM: 68.2% were realists, 7% were dogmatists, 8% were skepticists and 16.9% were rationalists. Although these positions are conceptualized as separate categories, there is a theoretical understanding that rationalists exhibit more sophisticated epistemological thinking than skepticists or dogmatists, and subsequently, these two positions are also more advanced than the first position of realism. Thus, these developmental positions could be viewed as a continuous variable whereby the four positions represented epistemological thinking ranging from less to more sophisticated. Correlations were then calculated between parental EOC developmental positions and the four parenting dimensions (See Table 7-7).

Table 7-7. Correlations of parental EOC developmental positions and parenting dimensions

	Autonomy-support	Responsiveness	Structure	Control
Parents' developmental position in EOCQ	.10	.08	.06	-.28**

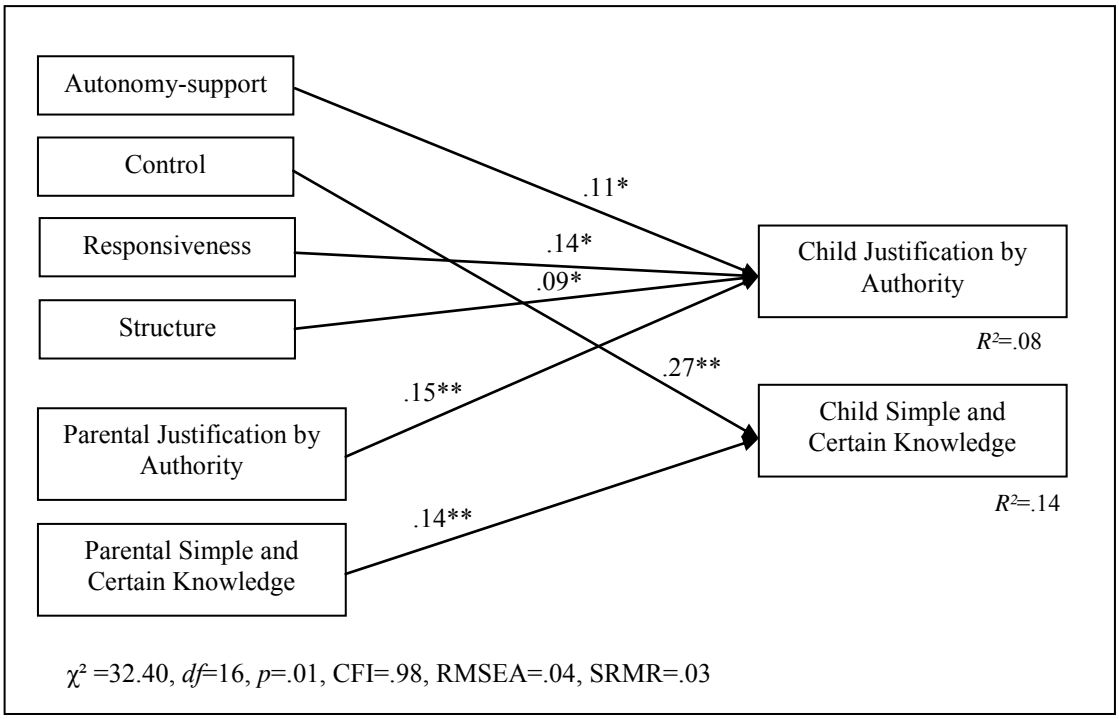
** $p \leq .01$

Correlation analyses revealed only one highly significant link: the higher the developmental positions that parents had, the less they practiced control in their parenting practices (r= -.28, p<.01). The other three parenting dimensions had insignificant correlations with parents' developmental positions in the EOCQ.

2.2 Do parenting practices and parents' EOC belief dimensions influence children's EOC belief dimensions?

Figure 7-4 shows the results of the structural model consisting of the effects of parenting dimensions and parental EOC belief dimensions on children's EOC belief dimensions. The fit indices were acceptable (χ^2 = 32.4, df = 16, p = .01, CFI = .98, RMSEA = .04, SRMR = .03).

Figure 7-4. Structural model of parenting dimensions and parental EOC belief dimensions on children's EOC beliefs dimensions



Note: SES is controlled for in the structural model. *p<.05, **p<.01

Firstly, with regards to the parenting dimensions: Autonomy-support, Responsiveness and Structure had positive direct effects on Child beliefs in JA (β= .11, p<.05, β= .14, p<.05 and β= .09, p<.05 respectively). This indicated that when parents provided more autonomy-support, were more responsive and provided greater structure, children demonstrated a stronger belief in the credibility of authority figures as justification for knowledge. Control, on the other hand, had a direct positive effect on Child beliefs in SC (β= .27, p<.01). When parents practiced more control, children demonstrated a stronger belief in knowledge being simple, concrete, unchanging and certain.

Additionally, with regards to the transmission of EOC belief dimensions from parents to children, significant dimension-specific transmissions were found. Parental beliefs in JA was found to have a positive direct effect on Child beliefs in JA (β= .15, p<.01). Similarly, Parental beliefs in SC was found to have a positive direct effect on Child beliefs in SC (β= .14, p<.01).

Table 7-8 provides the unstandardized and standardized estimates, standard deviations and variances of significant parameters from the structural model in Figure 7-4, for the comparison of effect sizes within and across samples.

Table 7-8. Decomposition of significant effects from structural model in Figure 7-4

Effect	Unstandardized coefficient	*SE*	Standardized coefficient	*SE*	R^2
Autonomy-support on Child JA	0.20	0.10	0.11	0.05	0.08
Responsiveness on Child JA	0.24	0.08	0.14	0.05	
Structure on Child JA	0.18	0.08	0.09	0.04	
Parent JA on Child JA	0.16	0.04	0.15	0.04	
Control on Child SC	0.36	0.05	0.27	0.04	0.14
Parent SC on Child SC	0.13	0.04	0.14	0.04	

2.3 Is there a positive relation between parents' developmental positions and children's developmental positions in the EOCM?

Similar to the method of determining parents' developmental positions from their beliefs in SC and JA dimensions, children's beliefs in SC and JA were first coded as low, mid and high, afterwhich their positions were determined from their profile across these two dimensions. 185 children had profiles that fit into the four positions: 23.2% were realists, 50.3% were dogmatists, 2.2% were skepticists, and 24.3% were rationalists.

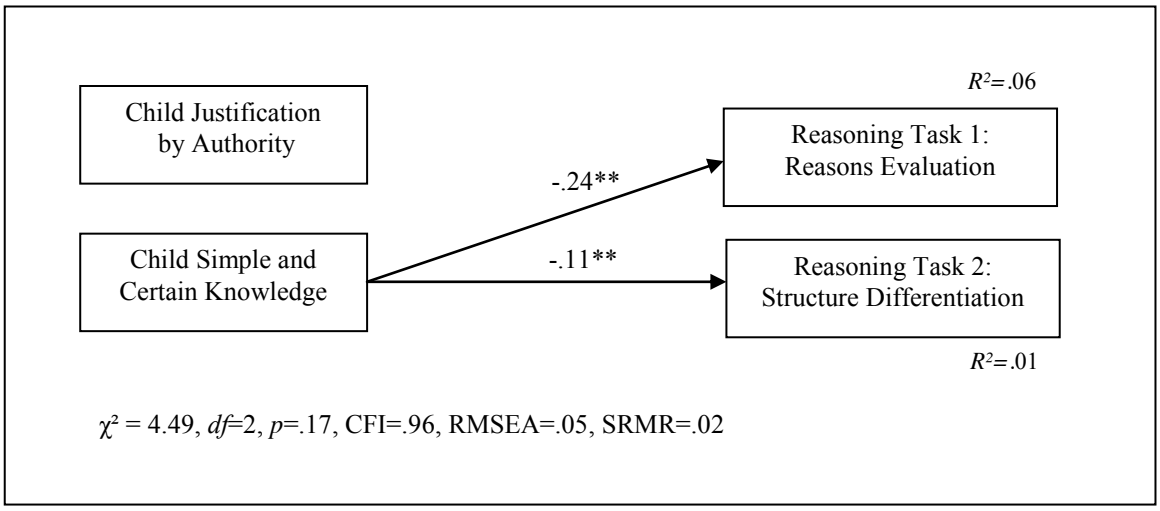
A correlation analysis showed that parent's and child's developmental positions was significantly correlated at φ_c=.32, p<.05. A regression analysis was subsequently conducted and the results showed that parent's developmental position was a significant predictor of child's developmental position (β=.25, p<.05) and accounted for 11% of the variance.

Research Question 3. Are dimensions and developmental positions of children's EOC beliefs significant predictors of their reasoning skills?

Preliminary correlation analyses showed three significant correlations between Child EOC belief dimensions and the two reasoning tasks (see Table 7-1). Child JA beliefs were negatively correlated with Structure Differentiation (r= -.09, p<.05) and

Child SC beliefs were negatively correlated with both tasks of Reasons Evaluation (r= -.23, p<.01) and Structure Differentiation (r= -.11, p<.05).

Figure 7-5. Structural model of children's EOC belief dimensions on their reasoning skills



Note: **p<.01

Figure 7-5 shows the results of the path analysis on the structural model. Fit indices were found to be acceptable (χ^2 = 3.55, df=2, p=.17, CFI=.96, RMSEA=.05, SRMR=.02). Child JA beliefs did not have any significant direct effects on reasoning skills. However, Child SC beliefs were found to have a direct negative effect on both skills of Reasons Evaluation (β= -.24, p<.01) and Structure Differentiation (β= -.11, p<.01). A stronger belief in knowledge being simple and certain was found to be detrimental to children's evaluative abilities in identifying quality of various reasons in argument and in evaluating overall argumentative structures.

Further analyses were then conducted in relation to children's developmental positions in the EOCM, as determined by their profiles across the JA and SC dimensions. Significant positive correlations were found between children's developmental positions and the two reasoning tasks: Reasons Evaluation (r= .18, p<.05) and Structure Differentiation (r= .22, p<.01). This indicated that the more sophisticated epistemic position the child achieved in the EOCM, the more skilled his/her reasoning was. Two linear regression analyses were then conducted to analyze if these EOCM positions were predictive of the separate reasoning skills. With regards to the first reasoning task of Reasons Evaluation, children's developmental position in the EOCM was found to be a significant predictor which accounted for 3% of the variance

(β= .18, p<.05). Additionally, children's developmental position was also significantly predictive of the second reasoning task of Structure Differentiation, accounting for 5% of the variance (β= .22, p<.01).

Table 7-9 provides the unstandardized and standardized estimates, standard deviations and variances of significant parameters from the structural model in Figure 7-5.

Table 7-9. Decomposition of significant effects from structural models in Figure 7-5

Effect	Unstandardized coefficient	*SE*	Standardized coefficient	*SE*	R^2
Child SC on Reasons Evaluation	-0.90	0.16	-0.24	0.04	0.06
Child SC on Structure Differentiation	-0.27	0.10	-0.11	0.04	0.01

Research Question 4. Can familial variables be significant mediators of the direct relationship of SES on children's reasoning skills and EOC beliefs?

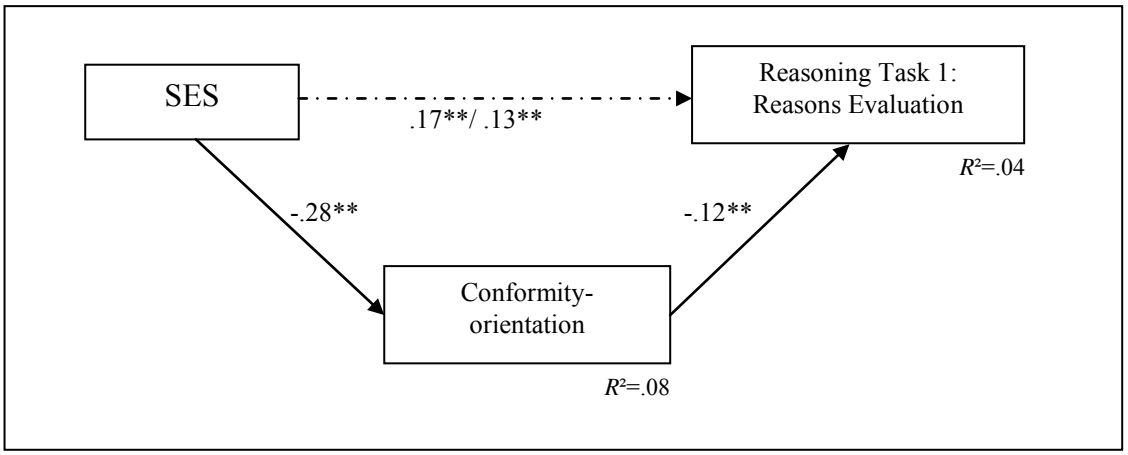
Referring to the correlations table (see Table 7-1), SES was found to be significantly associated with every variable in the model except for Conversation-orientation and Child JA beliefs. It was used as a control variable in all path analyses that included parenting variables, in order to eliminate confounding results which may be attributed to the influence of SES rather than to the postulated predictor variables. With the exception of the first structural model in Figure 7-1 which illustrated the direct effects of SES on the variables used, the other structural models revealed no difference in the significance of parameters between variables when SES was used as a control variable. Hence, SES parameters were not included in these figures when the results of the path analyses of the structural models were reported.

In addition to using SES as a control variable, the current work was also interested to test if competent parenting practices could act as compensatory mechanisms for reducing the direct influence of SES on child outcomes via the method of mediating models. In order to show successful mediation, significant direct relationships had to be first established between the predictor, mediating and outcome variables. In the following models, the predictor variable is SES, mediating variables are any of the familial components of parenting dimensions or family communication

patterns, and the outcome variables are children's reasoning skills and EOC belief dimensions. Significant relations of these variables were first identified from the previous analyses done. The correlations table (See Table 7-1) revealed that SES did not have a significant correlation with Child JA beliefs, thus Child JA beliefs was not further analyzed.

For the outcome variable of Reasons Evaluation, significant unmediated relationships were first established using correlations (see Table 7-1) between a) predictor variable SES and outcome variable (r= .17, p<.01); b) predictor variable SES and mediating variable Conformity-orientation (r= -.28, p<.01); and c) mediating variable Conformity-orientation and outcome variable (r= -.15, p<.01). Referring to Figure 6-6, the first model was estimated with only the direct path (dotted path) between predictor and outcome variables. The mediating variable and two additional path estimates were then added in to estimate the second model.

Figure 7-6. SES on children's reasons evaluation skills mediated by family conformity-orientation



Note: **p<.01

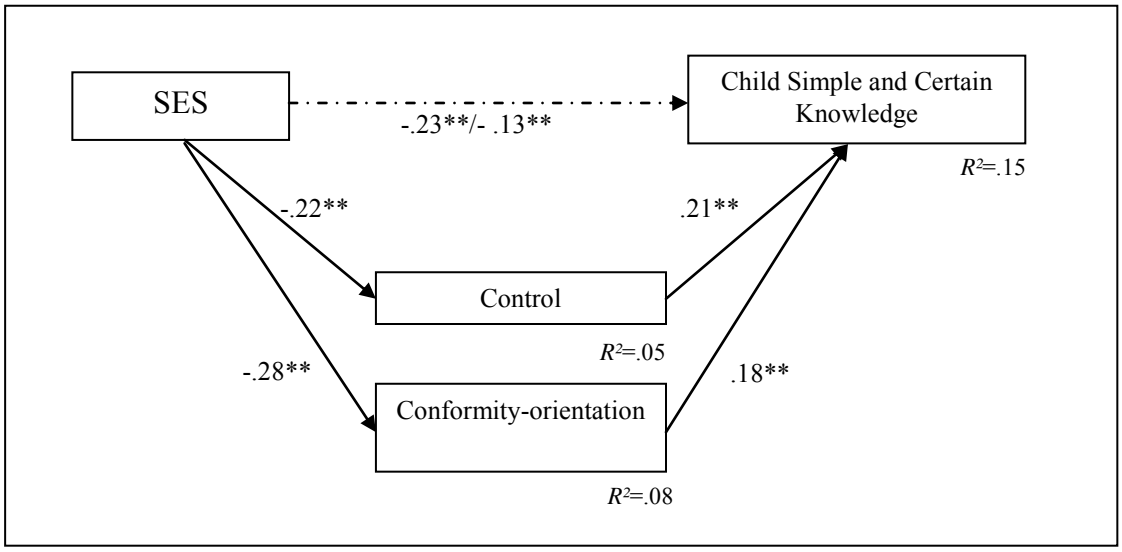
From Figure 7-6, partial mediation was supported as the relationship between predictor and outcome variables was reduced (β= .17, p<.01 to β= .13, p<.01) but this path parameter still remained significant. Thus, Conformity-orientation was significant in reducing the direct effects of SES on Reasons Evaluation skills but was unable to fully account for this variance.

For the outcome variable of Structure Differentiation, correlation analyses showed a significant relation with SES (r= .10, p<.01) but no significant relations were found between this variable and the parenting and family communication variables. It is

also interesting to note that the results in Figure 7-1 regarding the significant direct effect of Control on Structure Differentiation were only found when the structural model controlled for SES. Without SES as the control variable, this significant link was not found. Therefore, no mediating model was tested as the predictor variable and mediating variables did not evidence significant direct relations.

Lastly, for the outcome variable of Child SC beliefs, significant relationships were established between a) predictor variable SES and outcome variable (r= -.23, p<.01); b) predictor variable SES and mediating variables of Control (r= -.22, p<.01) and Conformity-orientation (r= -.28, p<.01); and c) mediating variables and outcome variable (r= .34, p<.01 for Control, r= .34, p<.01 for Conformity-orientation). Referring to Figure 7-7, the first model was estimated with only the direct path (dotted path) between predictor and outcome variables. The mediating variables and four additional path estimates were then added in to estimate the second model.

Figure 7-7. SES on Child SC beliefs mediated by parental control and family conformity-orientation



Note: **p<.01

From Figure 7-7, results supported partial mediation again as the relationship between predictor and outcome variables was reduced (β= -.23, p<.01 to β= -.13, p<.01) but this path parameter still remained significant. Thus, Control and Conformity-orientation acted as significant mediators in reducing the direct effects of SES on Child SC beliefs but were unable to fully account for the variance in Child SC beliefs.

The structural models in Figures 7-6 and 7-7 show that familial variables can significantly mediate the effect of SES on child outcomes. Fit indices for these models could not be estimated as these were fully recursive models, that is, all possible paths were included so the implied correlation always equaled the observed correlation, thus generating perfect fit. In these models, only the significance and size of parameters could be compared.

After establishing that familial variables of Control and Conformity-orientation can act as significant mediators of the direct effects of SES on Reasons Evaluation skills and Child SC beliefs, the following analyses were conducted to try to gain a deeper insight into the explanatory mechanisms behind these links. If familial variables are compensatory for direct effects of SES on outcomes, does this indicate that parents of low SES families who use less control and are less conformity-oriented have children who display on average higher reasoning competence and more advanced epistemic beliefs as compared to their peers? Similarly, can parents of high SES disadvantage their children by the use of high control and a more conformity-oriented family communication pattern? Comparing low and high SES class parents, the use of control and conformity-orientation in each class were first split into high/low groups by the 50th percentile of each variable.

Table 7-10. Splitting Control and Conformity-orientation into low and high groups

	Variables	Groups	Range	*N*	*M*	*SD*
Low SES	Control	Low	1.0-2.4	43	1.86	.42
		High	2.5-4.0	54	3.11	.48
	Conformity-orientation	Low	1.0-2.5	38	2.31	.53
		High	2.6-4.0	55	2.76	.48
High SES	Control	Low	1.0-2.0	111	1.63	.32
		High	2.0-4.0	103	2.63	.48
	Conformity-orientation	Low	1.0-2.0	124	1.59	.31
		High	2.0-4.0	80	2.69	.38

Note: 50th percentile for control (low SES) - 2.5; conformity-orientation (low SES) - 2.6; control (high SES) - 2.0; and conformity-orientation (high SES) - 2.0. Range for all variables 1 (min) to 4 (max).

For both low and high SES classes, the range of each group, number of participants per group, standard deviations, and means of both high and low groups concerning the use of Control and Conformity-orientation by parents are shown in Table 7-10. Out of 99 parents for low SES, 2 cases were missing for the Control variable (*N*=97) and 6 cases for Conformity-orientation (*N*=93). Out of 215 cases for high SES,

1 case was missing for Control (*N*=214) and 11 cases for Conformity-orientation (*N*=204). Due to the small fraction of missing data, these cases were removed from further analyses.

From Figure 7-6, Conformity-orientation acted as a significant mediator of direct effects of SES on Reasons Evaluation. Independent t-tests were conducted to analyze if the means of children's Reasons Evaluation skills between high and low use of Conformity-orientation within the family in the two SES classes were significantly different. From Table 7-11, for the low SES class, the difference between participants' Reasons Evaluation skills on average with regards to coming from a family with low or high Conformity-orientation was not significant, t (89) = .88, p>.05. Similarly, this difference for the high SES class was also not significant, t (201) = .36. p>.05.

Table 7-11. Means and Standard Deviations of children's reasons evaluation skills in low and high groups of Conformity-orientation situated in low and high SES classes

			Reasons Evaluation	Mean difference	*t*	*df*	*p*
Low SES	Low Conformity-orientation	*M*	12.62	.58	.88	89	.38
		SD	2.70				
	High Conformity-orientation	*M*	12.04				
		SD	3.36				
High SES	Low Conformity-orientation	*M*	14.10	.19	.36	201	.72
		SD	3.73				
	High Conformity-orientation	*M*	13.91				
		SD	3.46				

From Figure 7-7, Control and Conformity-orientation acted as significant mediators of the direct effects of SES on Child SC beliefs. A series of Analysis of Variance (ANOVA) was conducted to examine the separate and interactional effects of Control and Conformity-orientation on Child SC beliefs in both low and high SES samples. There was homogeneity of variance between groups in both samples as assessed by Levene's test for equality of error variances, thus ANOVA was allowed to be tested.

In the low SES sample, there was a non-significant interaction between effects of Control and Conformity-orientation on Child SC beliefs, F(1,77)=.00, p>.05. Main effects analysis found that children of parents who practiced low control had a significantly weaker belief in SC than children of parents who practiced high control, F(1,77)= 9.21, p<.01. However, differences in family Conformity-orientation showed

no significant effect on Child SC beliefs, $F(1,77)= 2.69$, $p>.05$. Table 7-12 contains the means and standard deviations of Child SC beliefs which were significantly different in families of the low SES sample. Therefore, only the factor of harsh parental control was found to significantly alter children's strength of belief in SC.

Table 7-12. Means, standard deviations and ANOVA results in low SES sample

		Child Simple and Certain Knowledge Belief (SC)	Mean Difference	*F*	*df*	*p*
Low Control	*M*	2.63	.61	9.21	1	.00
	SD	.92				
High Control	*M*	3.23				
	SD	.73				

In the high SES sample, there was a significant interaction between effects of Control and Conformity-orientation on Child SC beliefs, $F(1,181)=.5.24$, $p<.05$. Table 7-13 contains the means and standard deviations of children's SC beliefs taking into account different levels of both Control and Conformity-orientation in the family. When looking at these effects, children whose parents used low control scored lower in beliefs in SC than those whose parents used higher control, regardless if the family was low or high conformity-oriented. Low conformity-orientation with high control was found to have children with the strongest beliefs in SC, though low conformity-orientation with low control had children who showed the weakest beliefs in SC.

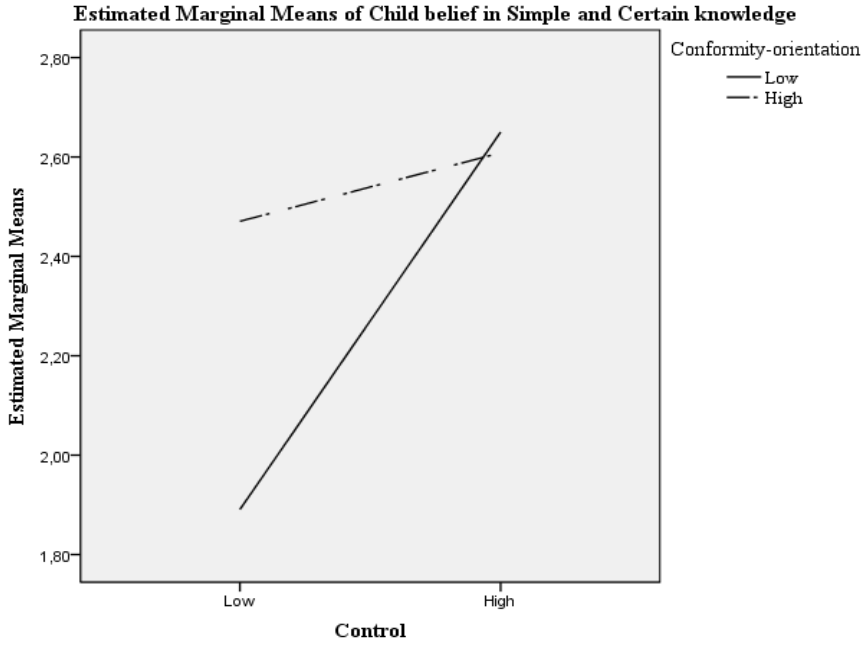
Table 7-13. Means and standard deviations of Child SC beliefs

Control	Conformity-orientation	*M*	*SD*
Low	Low	1.89	.67
	High	2.47	.96
High	Low	2.68	.87
	High	2.61	.84

Figure 7-8 shows the graphical form of the interactional effects of Control and Conformity-orientation on children's SC beliefs. From the graph, children of parents who exercised high control evidenced stronger beliefs in SC than those whose parents used low control. However, this was not the case for Conformity-orientation: children from families of high conformity-orientation did not always show a stronger belief in SC compared to children from families of low conformity-orientation. On one hand, when parents used high control, children evidenced strong beliefs in SC regardless of their family being conformity-oriented or not. On the other hand, when parents used

low control, children from families who had high conformity-orientation evidenced stronger beliefs in SC than children from families who had low conformity-orientation. Conformity-orientation seemed to make a difference on child beliefs in SC only when parents practised low control.

Figure 7-8. Interactional effects of Control and Conformity-orientation on Child SC beliefs in high SES sample



Main effects analyses also showed that both variables had significant individual effects. Table 7-14 contains the means and standard deviations of Child SC belief which were significantly different with regards to different levels of Control and Conformity-orientation in the family.

Table 7-14. Means, standard deviation and ANOVA results in high SES sample

		Child Simple and Certain Knowledge Belief (SC)	Mean Difference	*F*	*df*	*p*
Low Control	*M*	2.18	.45	10.93	1	.00
	SD	.75				
High Control	*M*	2.63				
	SD	.85				
Low Conformity-orientation	*M*	2.27	.27	3.94	1	.05
	SD	.81				
High Conformity-orientation	*M*	2.54				
	SD	.87				

Firstly, children of parents who practiced low control had significantly weaker beliefs in SC than children of parents who practiced high control, $F(1,181)= 10.93$, $p<.01$. Secondly, children from families which were less conformity-oriented showed significantly weaker beliefs in SC than children from families which were more conformity-oriented, $F(1,181)= 3.94$, $p<.05$. Therefore, low parental control and low family conformity-orientation were associated with weaker beliefs of children in SC. Children of parents who used lower control and emphasized less on conformity-orientation had the weakest beliefs in SC as compared to children of parents who used other combinations of control and conformity-orientation.

The above results reveal that familial practices can be protective factors to help children to develop more advanced beliefs about the complexity and evolving nature of knowledge, as opposed to it being simple and certain, regardless of families being in low or high SES classes. Thus far, the analyses have been conducted within each SES class. An additional analysis was conducted to compare between the two SES classes of high and low. As the above analyses have shown that interactional effects of Control and Conformity-orientation were only significant in high SES, these two variables were separately investigated to see if Child SC beliefs were significantly different between both groups when both sets of parents used a low level of control or when families were less conformity-oriented. Results showed that Child SC beliefs were on average significantly stronger, that is, less sophisticated, in low SES families ($M= 2.67$, $SD= .94$) as compared to those in high SES families ($M= 2.04$, $SD= .78$). This difference was significant $t\ (136) = 3.98$, $p<.01$. Similarly for families who have low conformity-orientation, child beliefs in SC were on average stronger in low SES families ($M= 2.68$, $SD= .87$) as compared to those in high SES families ($M= 2.13$, $SD= .81$). This difference was significant $t\ (146) = 3.32$, $p<.01$. Therefore, although familial practices can be significant to mediating the direct effects of SES, they are insufficient to fully negate the effects of SES on child beliefs. In the current study, children from low SES families had on average stronger beliefs in SC as compared to their peers from high SES.

CHAPTER 8
DISCUSSION

There are two purposes of the current dissertation. The first purpose is to formulate theoretical models based on the review of the literature for the goals of: a) investigating the influence of familial variables, specifically parenting practices and family communication patterns, on the fostering of children's informal reasoning skills and epistemological beliefs, b) empirically testing the relation between reasoning skills and epistemological beliefs in the domain of informal reasoning, which involves problem material of an everyday nature and c) evaluating if certain familial factors can mediate the direct effects of SES on the two child competencies, thus acting as possible protective factors for more optimal child development. The second aim is to test these structural models empirically through quantitative data analyses and path analyses.

A variety of questionnaires measuring parenting practices, family communication patterns and epistemological beliefs (i.e., EOCQ) were administered to a sample of 1994 participants: 997 fifth-graders and their parents. This data was taken from the longitudinal project FUnDuS "The role of familial support in the acquisition of argumentative competence in older children and adolescents" conducted in North-Rhine Westphalia, Germany. The measures of informal reasoning skills were only given to the fifth-graders and not the parents. The family communication patterns questionnaire and EOCQ had to be subjected to exploratory factor analyses as due to modifications made to the original scales, the expected factor structure was not confirmed. A third of the sample was extracted for the exploratory analyses. The results of these analyses were subjected to further confirmatory analyses with the remaining two thirds of the sample. All measures revealed an internal consistency of more than .6. Next, path analyses were conducted on the structural models with Mplus 6.0, with missing data being accounted for by using maximum likelihood estimation. The fit estimates of these models were deemed as acceptable, therefore the empirical data was found to fit the theoretical assumptions of the proposed structural models (cf. Kline, 2010).

In the next sections, the results of these analyses will be first discussed with regards to the four specific research questions. A general discussion will follow, which will highlight the most significant findings of the current dissertation and discuss the

implications, limitations and future research directions stemming from these results.

8.1 Research Questions

Research Question 1. Do familial variables such as parenting practices and family communication patterns influence children's informal reasoning competence?

1.1 Do parenting practices, in terms of the four dimensions of autonomy-support, control, responsiveness and structure, influence children's informal reasoning skills?

Out of the four parenting dimensions, only the dimension of control was found to significantly influence children's informal reasoning skills. The harsh and intrusive control that parents use to obtain child compliance was found to be detrimental for children's ability to successfully evaluate good reasons from poor ones. Controlling parents are less willing to listen in parent-child communication and less responsive to their children in the goal of promulgating their own views (Baumrind, 1996). Thus, reasoning opportunities for children within the family are limited. They articulate their views less, and are less able to evaluate and justify in family matters. This association of control with decreased evaluative competence of children is in line with previous literature on parental use of control. Past studies have established that intrusive control is harmful for child and adolescent development (cf. Grolnick & Pomerantz, 2009), with children of controlling parents displaying social withdrawal, internalizing and externalizing problems (cf. Barber et al., 2001; Soenens & Vansteenkiste, 2010) and lower academic performance (Gray & Steinberg, 1999).

When SES was controlled for, it was found that SES accounted for the variance explained by parental control on children's reasons evaluation skills but prompted a positive direct effect of control on structure differentiation, that is, children's ability to differentiate and rank varying arguments which differed in the use of components indicative of better arguments, such as metastatements, qualifiers and counterarguments. However, the positive direction of this association was unexpected. To conclude that parental control may be beneficial for reasoning skills is not in line with both theoretical literature and the results of the previous structural model without SES. A more possible

explanation for this positive association may be attributed to methodological issues such as increasing parameter estimates and error terms in the structural model.

Although the path analyses did not show significant effects of other parenting dimensions, correlation analyses showed that children's skills in reasons evaluation shared a significant positive correlation with parents' provision of autonomy-support and a negative correlation with control, although further path analysis only showed control to be predictive of this skill. Nevertheless, this positive correlation indicated that the provision of autonomy-support by parents, that is, parents' endorsement of self-initiated behavior from children, encouragement of child input and provision of choices, had a significant association with children's success in evaluating the quality of reasons in arguments.

The correlation analyses also provided an insight into the relations of parenting variables. It was found that when parents used more control, they provided less autonomy-support and responsiveness to their children. Thus, more controlling parents were in general less encouraging of self-initiated behavior from the child, less acknowledging of children's opinions, less inclined to provide choices and less willing to dedicate time and resources to their children. Interestingly, control was found to be positively correlated to structure. Previous literature would expect these two constructs to have a negative correlation as control is connected with pressure and coercion while structure is the organization of the environment to regulate child behavior and support child competence (Soenens & Vansteenkiste, 2010; Grolnick & Pomerantz, 2009). An explanation might be found in the work of Lorenz and Wild's (2007) who found similar results. They attributed this negative relation to children entering into adolescence perceiving parental structure as achievement-oriented pressure. This means that pre-adolescents begin to interpret structure - parental provision of clear guidelines and rules - as a manner of orienting their behavior towards adult standards and no longer as providing orientation and support in challenging situations.

1.2 Do family communication patterns partially mediate the relation between parenting practices and children's informal reasoning skills?

As mentioned in the results section, the partial mediation models involving family communication patterns could not be tested as the first analyses showed that most predictor variables regarding parenting dimensions were not significantly related

to the outcome variables of reasoning skills. The only exception was the significant effect of parental control. Thus, two simpler structural models were tested in place of the mediating model: the first structural model aimed to investigate if the two family communication patterns - conversation-orientation and conformity-orientation - could significantly predict children's informal reasoning skills, while the second model investigated the associations of the four parenting practices with family communication patterns at home.

The results showed that conformity-orientation was negatively predictive of children's skills in reasons evaluation but conversation-orientation had no effects on both reasoning skills. Families with high scores in conformity-orientation provide little space for divergent thoughts and opinions as they emphasize on the homogeneity of beliefs and attitudes and have an aversion to conflicts (Koerner & Fitzpatrick, 2002). Hence, the cognitively stimulating dialogic environment that children can have is limited. Without the allowance to actively discover, explore and articulate their own views and perspectives, children are less skilled in strategies of weighing, evaluating and identifying good quality reasons from poorer ones.

Conversation-orientation, that is the degree of unrestrained open family interactions about a wide range of topics, was found to not have a significant effect on both measures reasoning skills. Correlation analyses, however, revealed a significant association with one reasoning measure: the higher the frequency of family interactions across a range of topics, the better children performed in evaluating quality of reasons in arguments. Nevertheless, conversation-orientation was not shown to be a significant predictor of reasoning skills. This finding was not in line with past literature which has shown that individuals from conversation-oriented families are more influenced by the quality of arguments, such as the structure and quality of supporting evidence, and has better developed communicative and problem-solving skills, of which sound reasoning skills are assumed to be employed in (Fitzpatrick & Ritchie, 1994, Fitzpatrick & Koerner, 1996). A possible explanation may be that the effects of family communication on reasoning may depend more on how parents communicate and what these discussions entail, rather than on the quantity and frequency of family communication. Some types of communication, such as a parent's provision of rationales and explanations over matters of parent-child disagreement, may be more effective than others in shaping reasoning skills. A family may have a high frequency of

interactions, but these interactions do not necessarily involve high levels of specific and advanced reasoning skills such as articulating and evaluating one's reasons, the defence of one's standpoint with counterarguments and rebuttals, and the coherent formulation of a single conclusion with sound justifications. Stein & Albro (2001) also noted that arguments within the family can appear to be irrational due to the presence of implicit relational goals. The emotions for the family member are reflected in the interactions, hence although a wide range of topics in family discussions may be important to help the child to form a broad knowledge base to construct arguments from, the manner in which family conversations are conducted may be more significant for the promotion and advancement of specific and high-level reasoning skills.

The associations of the four parenting dimensions with conversation-orientation and conformity-orientation were also investigated. As expected, the results showed that an orientation towards conversation; open frequent discussions over a wide variety of topics is created when parents provide more autonomy-support, are more responsive, provide clear structure and use less intrusive control. These central components of authoritative parenting encourage active interactions between all members in the family. This form of openness and supportiveness of the communication between parents and children affects family functioning in positive manners (cf. Koerner & Fitzpatrick, 2002). This open channel of communication is also characteristic of the bidirectional style of communication between parents and children in authoritative parenting (cf. Baumrind, 1991).

In contrast, an orientation towards conformity; communication emphasizing homogeneity of attitudes, values and beliefs was evidenced when parents practiced low levels of autonomy-support, were less responsive to children's needs and used higher control. The positive association of conformity-orientation and control indicated that conformity in this context was achieved through parents' strict imposition of their own attitudes, beliefs and opinions on their children. It was not because children had internalized their parents' values and beliefs and were displaying volitional conformity as a sign of committed compliance under the SDT framework (cf. Kochanska, Coy & Murray, 2001). The results confirmed the perspective of Koerner and Fitzpatrick (2002) who theorized in the context of Baumrind's work that authoritarian parents would require the most conformity and permissive parents the least. Authoritative parents were placed in the middle of these two groups, requiring some conformity from children in

order to possibly provide some structure, harmony and guidance to family decisions. A high level of conformity in this context is therefore aimed at avoidance of conflicts and an emphasis on homogeneity and interdependence within the family, mostly at the expense of individual expressions of freedom.

Research Question 2. Do familial variables such as parenting practices and parental EOC beliefs influence children's EOC beliefs?

2.1 What are the associations between parental EOC beliefs and parenting practices?

The correlation analyses of the two dimensions of parental EOC beliefs of JA and SC and the four parenting dimensions - autonomy-support, control, structure and responsiveness - were examined to provide an insight into the associations between parental beliefs on knowledge and knowing and the practices that they use.

Concerning parental JA beliefs, the results indicated that that the more parents justified knowledge by means of authority, the less they provided clear and consistent structure for their children. In contrast, the stronger beliefs parents held in JA, the more they made use of controlling parenting techniques. Strong beliefs in JA implied seeing authorities as sufficient justifications for knowledge claims. In a child's life, parents may also see themselves as valid authorities who are children's providers of knowledge. When parents strongly believe in a hierarchical transmission of knowledge, they may see themselves as being more 'right' as compared to their children and thus be more inclined to use controlling strategies to attain obedience and compliance with little room for negotiation or discussion. On the other hand, when parents recognize that authorities are fallible and that learning and knowledge is not just a passive process of receiving and storing words of "experts", they come to understand knowledge and truth as human constructions that can be developed, identified, evaluated and communicated (cf. Belenky, Clinchy, Goldberger & Tarule, 1986). At the same time, knowledge continues to be dynamic, contextual and evolving. A more complex view of knowledge may reduce parents' reliance on controlling strategies as they recognize the fundamental significance of the child exploring and constructing his/her own knowledge views. Instead, they help to support this explorative process through the building of children's sense of self-efficacy, competence and self-regulation through the imposition of clear, consistent and developmentally appropriate expectations and guidelines (cf. Soenens &

Vansteenkiste, 2010; Skinner, Johnson & Snyder, 2005; Grolnick & Pomerantz, 2009). Parental provision of clear structure is also vital to reduce the complexity of the child's environment as it may be overwhelming for a child to navigate the muddy waters of knowledge construction when he/she recognizes the fallibility and uncertainty of knowledge claims. Parents have to be sensitive to what the child can manage and provide appropriate child-centered support to give the child a sense of predictability and security to explore, evaluate and develop their own knowledge base.

Concerning parental SC beliefs, the results showed that the stronger beliefs parents held in SC, the less autonomy-support they provided. They were also less contingently responsive to the needs of their children through the dedication of their time and resources. In contrast, stronger SC beliefs of parents were associated with higher use of control. This finding is similar to those of Ricco and Rodriguez's (2006): beliefs of knowledge as separate, discreet and unambiguous facts are related to more authoritarian practices. With an absolute view of knowledge, parents may not see the need for the inclusion of children's perspectives or to acknowledge that parenting standards have to be flexible and be subjected to change in accordance with children's development to ensure that they remained child-attuned and age-appropriate. Therefore, they provide less autonomy-support in terms of encouraging child-initiated expressions and views. They are less sensitive to the needs to the child and are less responsive to him/her.

Apart from examining the individual parental EOC dimensions of JA and SC, the correlations between the developmental positions of parents in the EOCM and parenting dimensions were also examined. Developmental positions were determined by the individual's profile across the two dimensions of JA and SC. The initial EOCM takes into account three EOC dimensions – JA, SC and Personal Justification. However, parents' and children's scores for the last dimension of personal justification were excluded from analyses as the internal consistency of this scale was found to be unsatisfactory. Despite the exclusion of personal justification, the four developmental positions of the EOCM were noted to be differentiable across the two dimensions of JA and SC in the ill-structured domains (see Table 7-6, taken from Chapter 7). Therefore, parents' developmental positions were subsequently determined with these two dimensions.

Table 7-6. Epistemic and Ontological Cognition Development Model (Greene et al., 2008)

Ill-Structured Domains			
Position	*SC*	*JA*	*PJ*
Realism	High	High	High
Dogmatism	Low	High	Low
Skepticism	Low	Low	High
Rationalism	Low	Mid	Mid

SC = Simple and Certain Knowledge Dimension; JA = Justification by Authority Dimension; PJ = Personal Justification Dimension

The development of EOC progresses with increasing sophistication across four stages – realism, dogmatism or scepticism, and rationalism. A total of 201 parents fit into one of the four positions, though conclusions could not be drawn with regards to the proportion of parents in each position relative to other positions as many parents did not fit into these strict categories and could not be included for analyses. Correlation analyses of these developmental positions and parenting dimensions revealed only one highly significant correlation between parents' developmental positions and parental use of control. The more advanced developmental positions that parents achieved in the EOCM, the less strict intrusive controlling strategies parents were found to employ. Kuhn (2005) found that parents who functioned at higher evaluativistic epistemological levels also tended to hold intellectual value inquiry and debate. Controlling strategies of intrusiveness and rigidity are incompatible with these intellectual values. Hence, parents who show higher epistemological thinking are more likely to endorse parenting strategies that are less authoritarian and more cognitively challenging for children, a finding also of Bond and Burns (2006).

2.2 Do parenting practices and parents' EOC belief dimensions influence children's EOC belief dimensions?

Firstly, the four parenting dimensions as predictors of children's EOC beliefs of JA and SC are discussed. The results showed that when parents provided autonomy-support, children tended to have stronger beliefs in JA. Additionally, children's beliefs in JA also increased when parents were more responsive in their dedication of time and

emotional support to the needs of the child and gave clear and consistent structure for child behaviour. These findings were not in line with expected hypotheses.

It was expected that strong beliefs in JA were indicative of lower epistemological thinking as the individual displays a high reliance on authority figures for guidance and the inclination of expressing to "know" something just because an expert, teacher or other reputable source said it. It was hypothesized that parental provision of a secure environment characterized by high autonomy-support, contingent responsiveness and supportive structure would not foster stronger beliefs in JA as children were made aware that authorities were not always conferred with infallible power and access to the "right" knowledge due to the self-constructive and evolving nature of knowledge made known by parents' encouragement of children to discover, explore and articulate their own thoughts. The acknowledgment of children's views enabled children to see the subjectivity and relativity of opinions and to realise the value of evaluating and justifying knowledge claims.

However, the present results showed otherwise. Positive associations were found between parental provisions of autonomy-support, structure and responsiveness and the JA beliefs of children. Furthermore, correlation analyses also revealed that family conversation-orientation was related to stronger JA beliefs of children. Therefore, contrary to expectations, children's beliefs in JA were found to be significantly associated with positive familial variables that built an open, stable and secure family environment.

The literature on epistemic trust can perhaps shed some light on these results. Epistemic trust refers to the reliance on others for the provision of reliable and accurate information due to recognition of one's own lack of expertise or experience (Harris & Koenig, 2006). Both children and adults depend on the verbal assertions and claims of others for the forming of a coherent understanding of the world, especially in areas when firsthand observations cannot be made. The interesting questions lie though in whom we trust for accurate knowledge, and the reasons behind this epistemic trust. For children, the main authorities whom they approach for epistemic knowledge are often familiar individuals in their everyday lives such as parents and teachers. Young children with secure attachment were found to favour their mothers' knowledge claims as compared to a stranger's claims when presented with novel objects that offered no

perceptual cues regarding their name or function, thus displaying higher epistemic trust in their mothers as reliable sources of information (Corriveau et al., 2009). There is a preference for familiar informants, but familiarity has been found to not be sufficient to elicit trust when the quality of parent-child relationship is poor. Securely attached children use the caregiver as a base from which to explore and they actively involve their caregiver in their interactions with objects. In attachment theory research, these caregivers are able to accurately interpret infants' needs, to respond contingently and to be flexible in altering instructional specificity according to child competence shown on a complicated task (Meins, Fernyhough, Fradley & Tuckey, 2001; Meins, 1997).

These findings of the relation between attachment styles and epistemic trust may explain the unexpected results found in this study. Strong JA beliefs indicate that children trust authorities to be sufficient justification for knowledge claims and epistemic trust literature demonstrates that a warm accepting secure climate fosters greater trust of children in familiar informants like their mothers. Thus, epistemic trust may act as a mediator between parenting climate and children's JA beliefs; accounting for the positive relation between the predictor variables of parenting dimensions and the outcome variable of children's JA beliefs at the pre-adolescence age. An authoritative parenting climate increases the epistemic trust children have in familiar authorities, such as parents and teachers in their personal lives. Due to this higher trust, they are subsequently shown to possess stronger beliefs in JA. Thus, "authorities" for the children sample may have been defined in a limited scope consisting of trusted individuals whom children have direct access to and can consult for knowledge, and may not extend to the wider scope of "authorities" in the field of epistemological thinking which also consists of experts in academic and vocational domains or institutional and governmental organizations.

The present results revealed positive associations of components of authoritative parenting such as autonomy-support, responsiveness and structure with children's JA beliefs. Authoritative parenting has been found to be positively associated with a secure attachment style (Karavasilis, Doyle & Markiewicz, 2003). The direction of effects is unclear but this positive association indicates that "parents who are warmly involved and encourage individual expression create a climate that fosters the development of attachment security, alternatively, more securely attached children may be more likely to elicit optimal parenting from their caregivers" (p. 162). A securely attached child

may also be less dependent upon strict limit-setting in order to exhibit age-appropriate behaviour. Thus, authoritative parenting may strengthen epistemic trust of children towards familiar authorities in their personal lives. In the same manner as attachment styles, parenting styles may act as moderators of children's trust in mothers' knowledge claims. Higher epistemic trust may thus evoke stronger JA beliefs of children.

However, it is important to take note that high epistemic trust does not indicate a blind unreasoned type of trust. Rather, further research shows that although children have high epistemic trust in some authorities whom they may share a good relationship with, they still examine these authorities' knowledge claims and verify their consistency with the available existing evidence. Corriveau et al. (2009) found that although securely attached children showed a preference to trust the claims of their mothers as compared to a stranger with novel objects, these changed when these claims could be verified with perceptual cues made available to the child and discrepancies were seen between what they observed and what was claimed. When the perceptual evidence of the test object favoured the stranger's claim instead of the mother's, securely attached children went with the stranger's claim. Thus, children showed reliance on trusted adults' knowledge claims when they could not make firsthand observations, but when perceptual cues became available and seemed contradictory to the claims of the familiar informants, they were shown to reject these claims.

Additionally, young children are also capable of monitoring the reliability of informants by their past record of epistemic accuracy (i.e., labelling familiar objects correctly). They monitored without external prompting and were found to give selective trust to the more accurate informant in situations whereby novel objects had to be labelled (Pasquini et al., 2007). Even with familiar individuals like teachers, young children moderated their trust depending on the informant's recent history of accuracy or inaccuracy (Corriveau & Harris, 2009a). Even after a week, children still showed selective trust in the more accurate informant (Corriveau & Harris, 2009b).

Connecting these findings back to the results of the current study, authoritative parenting may foster children's epistemic trust in the claims of familiar authorities, but even with this trust, children continue to evaluate adults' claims against the availability of their own personal experiences and observations. This is in line with the rationalist level of the EOCM, when individuals use both JA and PJ as means of justification to

warrant knowledge claims. Thus, the provision of an involved, structured and autonomy-supportive environment may foster high epistemic trust of children towards authorities, thus strengthening beliefs of authorities as sufficient justification for knowledge claims. However, these children are not blindly compliant or non-critical. On the contrary, they recognize the value of learning from others more expert than themselves and are capable of moderating this trust according to their own perceptual observations and the monitoring of the accuracy history of these informants. This epistemic trust and willingness to accept knowledge may be subsequently reflected in their epistemic beliefs. A note of caution should be taken regarding that the association between epistemic trust and JA epistemic beliefs may change as the child grows and develops as the parent-child relationship also undergo changes during the period of adolescence. The current results may only be indicative of the pre-adolescent sample tested in the study.

Moving on from children's JA beliefs to their SC beliefs, only parental control out of the four parenting dimensions was found to be significantly predictive of children's SC belief. Controlling techniques demand child conformity at the expense of individual freedom of expressions and autonomy, and parental knowledge may often be passed down as being fixed and non-negotiable. In having to accept and adhere to these adult standards without rationales or explanations, the child may come to hold stronger beliefs that knowledge is static, definite and absolute.

Additionally, between the two dimensions of SC and JA, a positive correlation was found. The more an individual believed in knowledge being definite, fixed and static, the more he/she also believed in authorities as sufficient justification to warrant knowledge claims. This correlation is in line with the wider literature, since lower developmental positions of epistemological thinking are associated with stronger beliefs in both dimensions (cf. Hofer & Pintrich, 1997). A realist has strong beliefs that knowledge is absolute and in direct correspondence to external reality, and shows a greater reliance on external authorities as experts and transmitters of knowledge. With progress, higher epistemological positions begin to view knowledge as increasingly tentative, complex and multi-faceted. Knowledge claims thus have to be evaluated and justified, and authorities may act as a means of justification but they should not be the sole means to verify these claims.

Apart from parenting dimensions, the associations of parents' EOC beliefs with children's EOC beliefs were investigated next. Dimension-specific transmissions of beliefs of EOC were shown to be significant from parent to child. Parental JA beliefs had a direct positive association with children's JA beliefs, while parental SC beliefs had a similar relation with children's SC beliefs. It has been noted that the definition of authorities may differ between the children and parent samples: children may limit authorities to their personal circle of familiar individuals from whom they seek direct epistemic help and teaching from, such as their parents and teachers, while parents may extend this definition beyond the scope of their personal lives to authorities in established institutions and governmental posts who are recognized as individuals with more expertise with regards to certain domains. However despite some differences in defining 'authorities', the definition of JA belief remains similar as the belief in authorities, personal or external, as sufficient justification for knowledge claims. Having JA beliefs per se is not indicative of poor epistemological thinking. Rather, it is when JA beliefs dominate as sole justifications for knowledge claims that they may become detrimental for the progress of epistemological thinking.

Parents with stronger JA beliefs may indicate and display more trust in external authorities and thus convey this method of knowledge justification to their children. Children may acquire this perspective of justifying knowledge and display a similar strong reliance and trust in authorities. Likewise for SC beliefs, parents who believe knowledge to be fixed, absolute and static will act in ways that are aligned to this belief, such as to have non-negotiable parental standards, and may thus convey this belief to their children through their actions and words.

As mentioned in the response to Research Question 2.1, parental JA and SC beliefs were found to be significantly associated with their parenting practices. Stronger parental SC and JA beliefs were associated with less optimal and effective parenting practices such as the higher use of control and lower provisions of autonomy-support, responsiveness and structure. Furthermore in family communication, correlations showed that stronger parental JA and SC beliefs were related to a higher tendency for conformity-orientation. Therefore, familial practices are to some extent reflective of parental epistemic beliefs, and may thus act as channels to transmit these beliefs to children. Changes in epistemological thinking can occur "through conscious cognitive

processes or through emotional or subconscious routes via persuasion" (Greene et al., 2008, p.155).

Although significant, the effect sizes of these parent-child transmissions are small. Value transmission research has found that "the topics on which parent-child agreement has been found to be strongest are those which are visible, concrete, and of lasting importance to parents. Abstract conceptions of values, transient issues and issues of little concern to the family have been found to have little or no parent-child transmission." (Hoge, Petrillo & Smith, 1982, p.570). Epistemological beliefs are abstract conceptions that even adults may not be consciously aware of, thus difficulties exist in formulating accurate measure of such tacit beliefs. This increases the difficulty of finding significant parent-child agreement. This may explain for the weak effect sizes found in the current study.

2.2 Is there a positive relation between parents' developmental positions and children's developmental positions in the EOCM?

Parents' developmental positions (i.e. realism, dogmatism, scepticism, rationalism) showed a positive relation to children's developmental positions, thus implying that the more advanced EOC positions that parents showed, the more advanced EOC positions children also displayed. A regression analysis further found that parents' developmental positions were significantly predictive of children's developmental positions. Parents who have more advanced epistemological thinking are therefore more able to inculcate more advanced representations of knowledge and knowing in their children. As Kuhn (2005) postulated, parental epistemological positions and intellectual values may create a subculture in which these values are the norm and children who belong to this subculture are highly likely to come to espouse them too. Cano & Cardelle-Elawar (2008) have confirmed the significance of the family's intellectual climate for children's epistemological beliefs, although these were beliefs about learning as measured by Schommer-Aikin's EQ (Schommer, 1990; see Chapter 4). Nevertheless, these results provide some empirical support for the significance of parents in the development of children's personal epistemological beliefs, a perspective long endorsed by Schommer-Aikins (2004) and Anderson (1984).

Research Question 3. Are dimensions and developmental positions of children's EOC beliefs significant predictors of their reasoning skills?

Children's beliefs in SC, but not in JA, were found to be a significant predictor of both aspects of reasoning tested: reasons evaluation and structure differentiation. Stronger beliefs in knowledge being concrete, definite and certain proved detrimental for children's evaluative skills in differentiating between quality of reasons and overall arguments. This confirms findings of past studies demonstrating that epistemological beliefs are powerful implicit factors which can enhance or constrain reasoning (cf. Kuhn et al., 2008; Yang & Tsai, 2009). Schommer & Hutter (1995) have shown that beliefs in SC influences one's willingness to think deeply and reflectively about current controversial, complex issues in everyday life: the more individuals believe in complex and tentative knowledge, the more willing they are to accept multiple perspectives, to modify their thinking, to withhold final decisions until reviewing all available information, and to acknowledge the complex, tentative nature of everyday issues.

Additionally, children's overall developmental positions in EOCM were found to be significantly predictive of both aspects of reasoning; higher positions were associated with better reasoning skills. The recognition of the value of skills in evaluation and justification of knowledge claims may be enhancing of reasoning skills as individuals who function at higher epistemological positions are more critical and therefore are more inclined to practice reasoning in various everyday situations. This finding confirms the importance of implicit epistemological beliefs to skilled reasoning. To focus on epistemological thinking is to focus on developing individuals who value reasoning, thinking and judgment. Mason and Scirica (2006) has suggested that the presentation and discussion of controversial topics can act as a means to stimulate change and refinement of epistemological thinking: in analyzing evidence, generating reasons, and making or defending claims, individuals are required to deal with the source, structure, and credibility of knowledge.

Research Question 4. Can familial variables be significant mediators of the direct relationship of SES on children's reasoning skills and EOC beliefs?

Based on previous results, two familial variables, namely control and conformity-orientation, were identified as possible mediators of the direct effect of SES

on two child outcomes: children's reasons evaluation skills and SC beliefs. These variables were identified as possible mediators as they had significant direct relations with both predictor and outcome variables. Successful mediation indicates that the mediator accounts, either fully or partially, for the relation between predictor and outcome, speaking to why or how such effects occur (Baron & Kenny, 1986).

The first mediating model showed that family conformity-orientation was significant in reducing the direct effect of SES on children's skills reasons evaluation. In the midst of disadvantaged environments characterized by lower SES, which have been shown to be related to less cognitive stimulation at home and lower cognitive functioning of children (Bradley & Corwyn, 2002), a lower degree of conformity-orientation can aid to provide children with increased cognitive stimulation through family discussions. Conversely, a higher degree of conformity-orientation can impede children's reasoning skills even in high SES environments, preventing them from reaching their full potential for good reasoning. Further within class analyses in the high and low SES samples, however, did not show significant differences of reason evaluation skills between children from families who were less conformity-oriented as compared to those who were more conformity-oriented.

The second mediating model showed that both control and conformity-orientation were significant in reducing the direct effect of SES on children's SC beliefs. In the low SES sample, there was no significant interactional effect of the two variables. However, a significant interactional effect was found in the high SES sample. Conformity-orientation was found to only significantly affect children's SC beliefs when parents practiced low control. When parents used high control, children's SC beliefs were strong regardless of the level of conformity-orientation in the family. When parents used low control, children from low conformity-oriented families had weaker SC beliefs than children from high conformity-oriented families.

In both samples, control was found to have a significant main effect on children's SC beliefs while conformity-orientation showed no significant main effect. Thus, parental control has emerged to be a highly significant factor associated with children having stronger beliefs of knowledge being simple, static, concrete and certain. Further analyses of child SC beliefs in low and high SES samples found that beliefs significantly differed between families who used high and low levels of control. In low

SES families, when parents exercised low control, children were found to exhibit significantly weaker beliefs in SC as compared to children whose parents exercised high control. Likewise, in high SES families, when parents exercised low control, children showed significantly weaker beliefs in SC as compared to those whose parents exercised high control. Thus differential levels of parental control are significant in altering child belief in SC in both low and high SES classes. The level of intrusive control that parents exert can shape children to see knowledge as fixed, concrete and static or to see it as complex, evolving and interrelated, which subsequently has effects on learning and reasoning. Even when children are in more advantageous high SES environments, the high use of parental control can impede children from having more advanced knowledge perspectives.

Therefore, in high SES, a family environment characterized by low parental control and low conformity-orientation is seen as most beneficial for the shaping of weaker SC beliefs in children. In low SES families, parental control is found to strengthen SC beliefs of children. Therefore in order for children to develop more complex and evolving views of knowledge, harsh and rigid parenting strategies should be kept to a minimum.

8.2 General Discussion

The above section has discussed the results in response to the four main research questions of the current work. This section aims to shortly highlight the most significant findings from the above sections and discuss their implications. The limitations of the current work will also be discussed along with directions for future work.

The above results provide some empirical support for the significance of parenting practices and family communication patterns on the fostering of children's informal reasoning skills and epistemic beliefs. The parenting dimension of control has emerged as a highly significant factor which is detrimental to the fostering of reasoning skills – in reasons evaluation skills (when not controlling for SES) and structure differentiation skills (when controlling for SES) - and to the fostering of epistemic beliefs.

Parental EOC beliefs were found to significantly predict children's EOC beliefs. There was a dimension-specific transmission of beliefs, with parental SC beliefs predictive of children's SC beliefs and likewise for JA beliefs. Parental developmental positions in the EOCM were also significantly predictive of child developmental positions. Therefore, a successful intergenerational transmission of EOC beliefs was seen.

In addition, parental EOC beliefs were found to share significant correlations to parenting practices, indicating that these implicit and often unconscious knowledge beliefs which parents hold have associations with the strategies that parents choose to use when bringing up their children. Parents who hold more sophisticated beliefs, that is, weaker beliefs in SC and JA, tend to use less controlling strategies and provide more autonomy-support, structure and responsiveness. They are also less inclined to focus on conformity-orientation in family communication efforts. A causal relationship between beliefs and behaviors is not suggested here; rather beliefs and behaviors are understood to be interdependent. "By interdependent,… neither beliefs nor behaviors are primary in causation; rather, each impacts the other and, in turn, is itself impacted by the other" (Koerner & Fitzpatrick, 2002, p.41).

Nonetheless, given the relevance of parental epistemological beliefs to parenting, parental interventions that enable parents to revise these beliefs may facilitate different parenting strategies and exert an indirect positive impact on child development when parents are supported to develop and advance their epistemological beliefs. Bond and Burns (2006) noted that "parenting behaviors do not occur within a vacuum; rather, they are embedded within parents' cognitive-developmental frameworks that guide parenting belief systems and behaviors. Thus in order to promote constructive parenting most effectively, we would do best to support parents' own social-cognitive development that is the foundation for developmentally responsive and supportive parenting" (p.563). They emphasized that to focus on the revision of parental epistemological beliefs is to focus on underlying frameworks that shape parenting behaviors which is more likely to produce sustained and effective parenting. Epistemological development through adulthood can be facilitated by intensive, systematic intervention, such as a program combining high quality reflective dialogue, individual and group narrative, and collaborative problem-solving in a safe and affirming setting has been found to lead to significant and sustained gains in young

mothers' epistemological growth (Bond et al., 2000). Naturally frequent occurrences of impactful experiences that challenge parents' currently held beliefs can also effect changes and advancement of their epistemological beliefs (cf. Belenky et al., 1986). In addition, mother's expectations and involvement in parent education classes have been shown to vary as a function of their epistemological perspectives (Burns and Bond, 2004). Thus, parenting programs can do more to promote parents' epistemological development for the improvement and sustenance of more constructive and effective parenting.

The current work also confirmed the significant association between children's epistemological beliefs and reasoning skills in the informal reasoning domain. More sophisticated representations of knowledge and knowing were associated with higher ability in evaluation of reasons and arguments. This result reinforces findings that epistemological beliefs are significant predictors of informal reasoning skills when applied to everyday problems (cf. Kuhn, 1991; Mason & Scirica, 2006), and to enhance children's epistemological beliefs will also lead to enhanced reasoning skills

With regards to enhancing children's epistemological beliefs, the extent to which children ask questions has been suggested as a significant factor to enable children to reflect on their own epistemology. Harris and Koenig (2006) asked if "persistent variation in the exchange of information via conversation leads to important differences among children in their working epistemology. More specifically, children may vary in the extent to which they think of dialogue, particularly dialogue involving questions, as an important vehicle for enlarging their understanding of aspects of the world that they have not personally experienced". Such a strategy is metacognitive in nature and compatible with suggestions made by psychologists to foster critical thinking (cf. Yang & Tsai, 2009; Kuhn, 1999). The manner in which children approach family communication in terms of the number and types of questions that they ask may be indicative of their working epistemology. Encouraging children to ask questions may help to increase the articulation of their self-initiated thoughts and to enhance their experience of viewing knowledge as constructive and evolving, thus advancing their epistemological thinking.

Lastly, further analyses of mediation models reinforce the significance of parenting practices and communication in optimizing the family environment for the

growth of the child. When parents use less control and enforce less conformity-orientation in the family, children are able to evidence better skills in reasons evaluation and weaker SC beliefs. In low SES families where children are disadvantaged in terms of available resources, support and cognitive stimulation, the use of more effective parenting strategies may act in a compensatory manner to reduce the negative effects associated with an impoverished environment, although this reduction is limited as SES affects child development through many channels (cf. Bradley & Corwyn, 2002). Likewise in high SES environments, parents' choice of harsh strategies and restrictive communication can impede the development of children's skills in reasoning and epistemological thinking.

8.3 Limitations

Firstly, the measures of parent-child communication may have been too global and not sufficiently specific and indicative of the level of reasoning used in family communication. The specificity of components of parent-child communication should therefore be increased in future work to gain a clearer idea of the distinct skills of reasoning used by parents, such as the extent to which they generate reasons in conflicts with children, the extent to which they defend their arguments and the likelihood of them providing reasonable justifications for their conclusions. Conversation-orientation did not show a significant effect on children's reasoning skills, implying that a high frequency of family interactions and discussion on a wide range of topics may not indicate the use of higher-level argumentative strategies. More specific measures investigating the frequency and types of argumentative strategies used in parent-child discussions (e.g. generating supportive reasons, counterarguments, rebuttals etc.) may be more beneficial to revealing significant relations between of family communication and children's reasoning skills. Dialogic exchanges between parent and child on topics which they may differ in opinions may also provide some insight to the naturalistic process of how children reason and imitate, acquire and refine their reasoning skills in home settings. Furthermore, the value that parents place on debates and their ways of allowing and expressing disagreement in the family can also be investigated as factors which can encourage or discourage reasoning within the family context.

Secondly, all measures of this study were based on a self-report methodology and only children's reports of parental behavior were used. Self-report measures allow one to use a substantially larger and more heterogeneous sample than what can be obtained through observational methods, and larger samples increase the chance of detecting theoretically important findings that may remain unidentified in smaller efforts (cf. Lamborn et al., 1991). However, the sole reliance on self-reports may lead to overestimation of some relations. With respect to children's reports of parents, some studies which have correlated objective assessments of family life with both adolescents' reports of their parents' behavior and with their parents' reports suggest that adolescents, not parents, are more accurate (cf. Gray & Steinberg, 1999). Researchers have also argued that children's perceptions of their parents' behavior are as important influences on their development as are parents' actual behavior (Brofenbrenner, 1979; Schaefer, 1965). In SDT, it is the degree to which adolescents perceive a sense of choice and volition from their parents that ultimately determine their self-determination and well-being (Soenens et al., 2007). Nevertheless, some of the obtained relations may be due to common source and method variance. Future work could do well to use multiple methods by combining self-reports with observations and to assess from different sources of information.

Furthermore, the lower internal consistencies of the children's epistemological scales as compared to the parent sample may have introduced a source of error that may have interfered with the statistical ability to reveal significant associations. The results also showed that more than half of the sample of children who could be classified into EOC developmental positions (N= 185) were dogmatists. Thus in the children sample, there may have been insufficient variance in children's EOC positions to reveal stronger effect sizes and may account for the weaker correlations with other variables in this study.

Lastly, due to time limitations and the large sample size, the measures of informal reasoning competence were restricted to mainly evaluative skills in differentiating quality of reasons and arguments. Other components of reasoning skills (e.g. generation of reasons, counterarguments, and justifications) should also be measured in future work in order to provide a more balanced and comprehensive indicator of the overall reasoning skills that children have. Additionally, the associations found in this work should be further studied while controlling for other factors which

are not measured in this study but have demonstrated associations with reasoning. Some examples are cognitive ability such as intelligence (cf. Means & Voss, 1996; Perkins, Faraday & Bushey, 1991) and language competence (cf. Kuhn, 1991).

8.4 Future Research Directions

In the current work, parenting practices and family communication patterns have been studied in a linear fashion in relations to children's epistemological beliefs and reasoning. Significant associations were evidenced, but further research should investigate if more complex relations between parenting variables and child outcomes exist, such as if curvilinear effects are more representative of these relations. Structure has been found to have curvilinear relations with academic performance (Kurdek, Fine & Sinclair, 1995), self-regulation (Kurdek & Fine, 1994) and psychosocial development (Gray & Steinberg, 1999); moderate levels of structure are perceived to be more beneficial compared to high levels of structure as high structure may be viewed as adult imposition of rigid control. Similarly, autonomy-support has been found to have a curvilinear relation with psychosocial development, with greatest gains evidenced for increases from moderate to high levels of autonomy support (Gray & Steinberg, 1999). Likewise, responsiveness also showed a curvilinear relation with psychosocial development whereby the greatest gains were seen with increases from low to moderate, and from moderate to high levels of responsiveness (Gray & Steinberg, 1999). Thus, in the same manner with respect to reasoning, structure may be more beneficial at moderate levels. Too little structure can be chaotic (Skinner, Johnson & Snyder, 2005) while too much can be perceived as intrusive control. Additionally, the amounts of autonomy-support and responsiveness may be only beneficial when they pass through certain critical thresholds. After these thresholds, the effects on children may reach a temporal or permanent plateau. These curvilinear relations may also be reflective in the fostering of children's epistemological thinking and reasoning, whereby parental provisions of autonomy-support, responsiveness and structure may only be significant and optimal they fall in a certain threshold. Further work can seek to clarify and specify these relations.

Additionally, the interactive effects of different parenting practices should be analyzed. The different dimensions of parenting evidence significant correlations with

each other and this statistical overlap may account for shared variance in aspects of child development. Gray and Steinberg (1991) noted that this overlap may simply reflect the actual nature of parenting styles as no single characteristic of a parents' behavior exists entirely independent of other qualities. They found that components of authoritative parenting not only acted independently to influence adolescent competence, but also acted in combination with each other. Some parenting practices can be compensatory for others in achieving positive developmental outcomes, such as their finding that the presence of autonomy-support is an adequate protective factor against adolescent psychological distress in the absence of parental responsiveness and vice versa.

Future research should also be directed towards a longitudinal data set in order for causal conclusions to be drawn. However, although the methodology of the current study restricts claims of causality, it does provide a preview of the significant associations of familial variables to aspects of children's reasoning and epistemological beliefs. Longitudinal data can help establish the extent to which familial variables are causal to changes in children's reasoning and beliefs. Furthermore, it can also investigate the bidirectionality of the parent-child relation by monitoring over-time changes in parenting practices and communication strategies as a function of changes in children's reasoning ability and epistemological thinking. It seems logical to presume that as children develop in their cognitive competence, parents would also have to adjust their parenting strategies and communication methods in order to remain child-attuned.

Last but not the least, the family consists of more than just parents; the only socialization agents which were investigated in this study. It will also be interesting to look at the role of other key members such as siblings, or extended family members who may have frequent and regular contact with children, such as grandparents, and investigate their roles in fostering change in children's reasoning skills and epistemological beliefs. With a wider scope, a more comprehensive and fine-grained picture of the role of family in fostering these cognitive competencies may be obtained.

CHAPTER 9
CONCLUSION

Education, both formal and informal, should seek to cultivate a thinking generation. Inherent in the ability to think well are the competence for skilled reasoning and implicit epistemological beliefs which can enhance one's reasoning. The current dissertation had two broad aims focusing on these two aspects of children's thinking - informal reasoning skills and epistemological beliefs, where the influence of family and parental socialization have been less explored. The first aim was to formulate informed theoretical models based on the findings of current literature while the second was to empirically test these models with the use of quantitative statistical analyses and path analyses. These models informed by past theoretical and empirical research consisted of three objectives:

1. to explore the influence that familial variables had on two associated child outcomes - children's informal reasoning, which has an inherent emphasis on argument skills, and children's epistemological beliefs, which are conceptualized in this study under Greene et al.'s (2009, 2010) EOCM,

2. to test the significance of this association between children's informal reasoning skills and their personal epistemological beliefs as demonstrated in previous studies studying reasoning and epistemological thinking, and

3. to investigate if familial factors can significantly mediate the direct effects of socioeconomic status, which has an established influence on family and parenting factors, on these child outcomes.

These aims were directed towards answering research problems identified in the literature on informal reasoning and personal epistemology. The first concerned the scarcity of family-based research in both informal reasoning and personal epistemology development. The second was the need for a more informed understanding of the skills of informal reasoning implicated in everyday life, as compared to formal reasoning with well-structured problem material which has been a prominent topic of cognitive psychologists for many decades. The third concerned the significant relation of reasoning and epistemological beliefs evidenced in many studies of scientific reasoning and the need to further investigate this within the domain of informal reasoning.

The significant results of the current work are summarized below with regards to the three above-mentioned objectives of the hypothesized theoretical models which were subjected to empirical testing:

1. Although modest, certain familial variables were shown to be significant for the fostering of the two cognitive aspects of good thinking:

    a) Children's informal reasoning skills - the use of harsh parental control and a conformity-orientated family communication pattern were found to be detrimental for children's evaluative reasoning skills.

    b) Children's personal EOC beliefs – the use of harsh parental control fostered stronger beliefs in simple and certain knowledge, thus contributing to lower-level epistemological thinking. Parents' EOC beliefs showed significant correlations to their parenting practices, with more advanced beliefs associated with more effective practices. Parental EOC beliefs were also shown to be significant predictors of children's EOC beliefs, with successful transmissions from parent to child occurring within each dimension and also in their overall developmental positions. In this study, unexpected associations between children's beliefs in justification by authority and parenting variables characteristic of authoritative parenting were found. These associations have been attributed to the possibility of the mediating factor of epistemic trust.

2. The association between children's informal reasoning skills and EOC beliefs was found to be significant, confirming previous research. Beliefs in simple and certain knowledge significantly predicted children's reasoning skills: stronger beliefs led to decreased competence in both evaluation of quality of reasons and arguments. Children's overall EOC developmental positions also significantly predicted evaluative reasoning skills, with higher positions evidencing better evaluative skills.

3. Mediating models analyses showed that the use of parental control was significant in altering the effects of SES on both outcomes of children's reasoning and EOC belief. Children of parents who exercised less harsh control displayed higher reasoning skills of evaluating quality of reasons in arguments

and held weaker beliefs in knowledge being simple and certain. In high SES families where parents practiced low control, conformity-orientation was found to be an additional significant mediator on children's simple and certain knowledge beliefs. A low degree of conformity-orientation in family communication was beneficial to fostering weaker beliefs in knowledge being simple and certain; an indicator of higher-level epistemological thinking.

The home environment provides countless opportunities for parents to provide cognitive scaffolds for the advancement of children's reasoning skills and epistemological beliefs. It is insufficient for parents to solely rely on telling children the value of argument as a model to knowing, for as Kuhn (2005) wisely noted: "intellectual values cannot be instilled by exhortation – by telling students that a particular kind of activity is valuable, or even how or why it is valuable. Only their own experiences can lead them to the conviction that inquiry and reasoned argument offer the most promising path to deciding between competing claims, resolving conflicts, solving problems and achieving goals. The more fruitful adult role is that of introducing young people to activities that have a value that becomes self-evident as the youths engage them and develop the skills they entail. An essential aspect of the adult's role is conveying his or her belief in the value of the activity and commitment to it. As students' skill and commitment and self-direction increase, the adult's role fades" (Kuhn, 2005, p.35-36). Parents therefore have to provide the opportunities for children to experience the use of argumentative reasoning in everyday life and to see its worth in their own practice of it. At the same time, parents are the models whom children look up to, and their beliefs and commitment to the value of these skills are essential for children to also develop their own beliefs and commitment to the intrinsic and instrumental significance of effective reasoning.

At this point, it is important to note that even with family and school efforts, the advancement of reasoning and epistemology is not expected to be accomplished in a short period of time. While it is important to provide children with opportunities for reflective dialogue and space to articulate, observe and practice their argument skills, there is a need to give time for the maturation of the epistemic and metacognitive levels of cognition. As epistemological developmental models point out: the progression of personal epistemology takes time and is significant related to one's educational experiences (see Chapter 4). With regards to argument skills, major improvements in

various strategies have been evidenced across preadolescence to early adolescence (Kuhn, 1991). This is congruent with the wider developmental literature regarding Piaget's cognitive stage of formal operations and Vygotsky's theory which regarded metacognitive thought as absent till late childhood (cf. Kuhn, 1991).

Contribution to knowledge

The current research makes its contribution to the scarce empirical work regarding the role of family, specifically concerning parents as socialization agents, in the development of children's good thinking with specific focus on their informal reasoning skills and epistemological beliefs. Previous literature has contained hints of these relations but lacked empirical support to show for it. Thus, this work elaborated on these hints with well-established theories from the parenting literature to formulate research hypotheses for empirical testing. The results of this empirically-based study contribute to a more informed understanding of the significant influence of familial practices on these two components inherent in children's ability to think well.

Kuhn (2005) wrote that "all parents claim to want better schools for their children, but they themselves often do not live lives that demonstrate a respect for education and respect. In the end, we can only promote the development of intellectual values in young people to the extent that the communities of which they are a part of themselves reflect these values" (p.130). Therefore, as much as the school environment plays a major role in developing children's competencies and thinking, it is but only a part of the child's life and community. Every child is embedded in a complex multi-level system (cf. Bronfenbrenner, 1979), and the family environment is central to the progress of child development due to its direct and frequent contact with the child. Parents are the main socialization agents in the home setting. Thus, in order for children to become good reasoners and thinkers, parents must also develop and model good reasoning and epistemological thinking in order to consistently reflect and promote effective thinking to their children at home. Furthermore, parents' epistemological beliefs have also been shown to influence their parenting and communicative strategies. Thus there is a need to focus on the revision of parental epistemological beliefs so as to focus on the underlying frameworks that shape parenting behaviors which is more likely to produce sustained and effective parenting (Burns & Bond, 2006; Bond, Belenky & Weinstock, 2000).

Returning to the starting words of this dissertation where Marybeth Hicks (2012) wrote "imagine what might happen if we stop parenting by thoughtlessly developing habits over time and instead institute fundamental changes in the way we approach our roles as parents. Suppose we all thought more about what we're doing and used the knowledge we gain in our thinking to do things better". To focus on parents' epistemological beliefs is to focus on their thinking which underlies what they are doing. If fundamental changes are effected in their epistemological beliefs, more effective parenting and communication strategies may come into play. This combination of more advanced epistemological beliefs and effective parenting practices increases the inclination for children to develop successfully as thinkers; capable of more sophisticated knowledge views and of more effective and skilled reasoning in everyday life. This provides the platform for them to be meaningfully engaged in personal and societal issues; flourishing in their personal lives and contributing maximally to the wider society. Therefore, the more parents themselves know and practice good thinking, powered by the knowledge generated through research by educators, scientists and psychologists, the more mindful and effective parenting can become. In answer to Hicks (2012) challenge to imagine what might happen with more mindful parenting, a probable answer might well be that the next generation of children will become better thinkers; flexible and strategic in their ability to inquire, analyze and evaluate. Imagine the implications of that.

REFERENCES

Alexander, P. A., Murphy, P. K., Guan, J., & Murphy, P. A. (1998) How students and teachers in Singapore and the United States conceptualize knowledge and beliefs: Positioning learning with epistemological frameworks. *Learning and Instruction, 8*, 97–116.

Amsterlaw, J. (2006). Children's beliefs about everyday reasoning. *Child Development, 77*, 443 – 464.

Anderson, R.C. (1984). Some reflections on the acquisition of knowledge. *Educational Researcher, 13*, 5-10.

Assor, A., Roth, G., & Deci, E. L. (2004). The emotional costs of perceived parents' conditional regard: A self-determination theory analysis. *Journal of Personality, 72*, 47–89.

Bandura, A. (1997). *Self-efficacy: The Exercise of Control*. New York: Freeman.

Bandura, A. (2001). Social cognitive theory: an agentic perspective. *Annual Review of Psychology, 52*, 1-26.

Barber, B. K. (1996). Parental psychological control: Revisiting a neglected construct. *Child Development,67*(6), 3296-3319.

Barber, B. K., & Harmon, E. L. (2002). Violating the self: Parental psychological control of children and adolescents. In B. K. Barber (Ed.), *Intrusive parenting* (pp. 15-52). Washington, DC: American Psychological Association.

Barber, B. K., & Olsen, J. A. (1997). Socialization in Context: Connection, Regulation, and Autonomy in the Family, School, and Neighborhood, and with Peers. *Journal of Adolescent Research,12*, 287-315.

Barber, B. K., Bean, R. L., & Erickson, L. D. (2001). Expanding the study and understanding of parental psychological control. In B. K. Barber (Ed.), *Intrusive parenting: How psychological control affects children and adolescents*. (pp. 263-289). Washington, DC: American Psychological Association.

Barber, B. K., Olsen, J. E., & Shagle, S. E. (1994). Associations between parental psychological and behavioral control and youth internalized and externalized behaviors. *Child Development,65*,1120-1136.

Barber, B. K., Stolz, H. E., & Olsen, J. A. (2005). Parental support, psychological control, and behavioral control: Assessing relevance across time, method, and culture. *Monographs of the Society for Research in Child Development,*70(4), 1-137.

Baron, R. M., & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology, 51*(6), 1173-1182.

Baumrind, D. (1967). Child care practices anteceding three patterns of preschool behavior. *Genetic Psychology Monographs,75*, 43-88.

Baumrind, D. (1971). Current patterns of parental authority. *Developmental Psychology Monograph, 4*(1), 1-103.

Baumrind, D. (1966). Effects of authoritative parental control on child development. *Child Development*, *37*(4), 887-907.

Baumrind, D. (1978). Parental disciplinary patterns and social competence in children. *Youth and Society, 9*(3), 239-276.

Baumrind, D. (2005). Patterns of parental authority and adolescent autonomy. *New Directions for Child and Adolescent Development,108*, 61-69.

Baumrind, D. (1975). The contributions of the family to the development of competence in children. *Schizophrenia Bulletin, 14*, 12-37.

Baumrind, D. (1996). The discipline controversy revisited. *Family Relations, 45*(4), 405-414.

Baumrind, D. (1991). The influence of parenting style on adolescent competence and substance use. *The Journal of Early Adolescence, 11*(1), 56-95.

Baumrind, D., & Black, A. E. (1967). Socialization practices associated with dimensions of competence in preschool boys and girls. *Child Development, 38*, 291-327.

Baumrind, D., Larzelere, R. E., & Owens, E. B. (2010). Effects of Preschool Parents' Power Assertive Patterns and Practices on Adolescent Development. *Parenting: Science and Practice, 10*, 157-201.

Belenky, M. F., Clinchy, B., Goldberger, N., & Tarule, J. (1986). *Women's ways of knowing: The development of self, voice and mind*. New York: Basic Books.

Bendixen, L. D., & Rule, D. C. (2004). An integrative approach to personal epistemology: A guiding model. *Educational Psychologist, 39,* 69–80.

Bond, L. A., & Burns, C. E. (2006). Mothers' beliefs about knowledge, child development, and prevention strategies: expanding the goals of parenting programs. *The Journal of Primary Prevention*, *27*(6), 555-571.

Bond, L., Belenky, M. F., & Weinstock, J. S. (2000). The listening partners program: an initiative toward feminist community psychology in action. *American Journal of Community Psychology, 28*, 697-730.

Boyes, M. C., & Chandler, M. J. (1992). Cognitive development, epistemic doubt and identity formation in adolescence. *Journal of Youth and Adolescence, 21*(3), 277-304.

Bradley, R. H. & Corwyn, R. F. (2000). Measuring the home environments of children in early adolescence. *Journal of Research on Adolescence, 10*(3), 247-288.

Bronfenbrenner, U. (1979). *The Ecology of Human Development*. Cambridge, MA: Harvard University Press.

Buehl, M. M., & Alexander, P. A. (2001). Beliefs about academic knowledge. *Educational Psychology Review, 13(*4), 385–418.

Buehl, M. M., & Alexander, P. A. (2005). Motivation and performance differences in students' domain-specific epistemological belief profiles. *American Education Research Journal, 42*, 697–726.

Buehl, M. M., Alexander, P. A., & Murphy, P. K. (2002). Beliefs about schooled knowledge: Domain specific or domain general? *Contemporary Educational Psychology, 27*, 415-449.

Burleson, B. R., Delia, J. G., & Applegate, J. L. (1992). Effects of maternal communication and children's social-cognitive and communication skills on children's acceptance by the peer group. *Family Relations, 41,* 264–272.

Burns, C. E., & Bond, L. A. (2004). The relationship between mothers' beliefs about knowledge and their experiences in parent education. *The Journal of Primary Prevention*, *25,* 417–439.

Cano, F., & Cardelle-Elawar, M. (2008). Family environment, epistemological beliefs, learning strategies, and academic performance. In M. S. Khine (Ed.), *Knowing, knowledge and beliefs. Epistemological studies across diverse cultures* (pp. 219–240). New York: Springer.

Cauffman, E., & Steinberg, L. (March, 1995).*Moderating effects of neighborhood parenting on family socialization processes*. Paper presented as part of a symposium entitled "Community Effects on adolescent development: new approaches to the study of neighborhoods and their impact" at the biennial meetings of the Society for Research in Child Development, Indianapolis, IN.

Chambliss, M. J., & Murphy, P. K. (2002). Fourth and fifth graders representing the argument structure in written texts. *Discourse Practice, 34*, 91-115.

Chandler, M. J., Hallett, D., & Sokol, B. W. (2002). Competing claims about competing knowledge claims. In B. K. Hofer & P. R. Pintrich (Eds.), *Personal epistemology: The psychology of beliefs about knowledge and knowing* (pp. 145–168). Mahwah, NJ: Erlbaum.

Clarebout, G., Elen, J., Luyten, L. & Bamps, H. (2001). Assessing epistemological beliefs: Schommer's questionnaire revisited. *Educational Research and Evaluation, 7*, 53-77.

Conley, A.M., Pintrich, P. R., Vekiri, I., & Harrison, D. (2004). Changes in epistemological beliefs in elementary science students. *Contemporary Educational Psychology, 29,* 186-204.

Corriveau, K., & Harris, P. L. (2009a). Choosing your informant: weighing familiarity and recent accuracy. *Developmental Science, 12*(3), 426-437.

Corriveau, K., & Harris, P. L. (2009b). Preschoolers continue to trust a more accurate informant 1 week after exposure to accuracy information. *Developmental Science, 12*(1), 188-193.

Corriveau, K. H., Harris, P. L., Meins, E., Fernyhough, C., Arnott, B., Elliott, L., Liddle, B., Hearn, A., Vittorini, L., & Rosnay, M. (2009). Young children's trust in their mother's claims: longitudinal links with attachment security in infancy. *Child Development, 80*(3), 750-761.

Darling, N., & Steinberg, L. (1993). Parenting style as context: an integrative model. *Psychological Bulletin , 113*(3), 487-496.

Darling, N., Steinberg, L., & Gringlas, M. (March, 1993). *Community integration and value consensus as forces for adolescent socialization: a Test of the Coleman and Hoffer hypothesis*. Paper presented as a part of the symposium entitled "Community and Neighborhood Influences on Adolescent Behavior" at the biennial meetings of the Society for Research in Child Development, New Orleans.

Day, J., French, L., & Hall, L. (1985). Social influences on cognitive development. In D. Forrest-Pressley, G. MacKinnon, & T. G. Waller (Eds.), *Metacognition, cognition, and human performance: Theoretical perspectives* (Vol. 1) (pp. 33-56). Orlando, FL: Academic.

Deci, E.L. & Ryan, R.M. (1985). *Intrinsic motivation and self-determination in human behaviour*. New York: Plenum Press.

Deci, E.L., & Ryan, R.M. (2000). The "what" and the "why" of goal pursuits: Human needs and the self-determination of behaviour. *Psychological Inquiry*, *11*, 227-268.

Deci, E. L., & Ryan, R. M. (2008). Self-Determination Theory: A macrotheory of human motivation, development, and health. *Canadian Psychology , 49*(3), 182-185.

Deci, E., Eghrari, H., Patrick, B., & Leone, D. (1994). Facilitating internalization: The self-determination theory perspective. *Journal of Personality, 62*, 119-142.

Deci, E. L., Driver, R. E., Hotchkiss, L., Robbins, R. J., & Wilson, I. M. (1993). The relation of mothers' controlling vocalizations to children's intrinsic motivation. *Journal of Experimental Child Psychology*, *155*, 151-162.

Dornbusch, S.M., Ritter, P.L., Leiderman, P.H., Roberts, D.F., & Fraleigh, M.J. (1987). The relation of parenting styles to adolescent school performance. *Child Development, 58*, 1244-1257.

Duell, P. K., & Schommer-Aikins, M. (2001). Measures of people's beliefs about knowledge and learning. *Educational Psychology Review, 13*(4), 419-449.

Durkin, K. (1995). *Developmental Social Psychology: From infancy to old age*. Malden, MA: Blackwell.

Eisenberg, A. R. (1992). Conflicts between mothers and their young children. *Merrill-Palmer Quarterly, 38*, 21–43.

Eisenberg, A., & Garvey, C. (1981). Children's use of verbal strategies in resolving conflicts. *Discourse processes, 4*, 149-170.

Enders, C. K., & Bandalos, D. L. (2001). The relative performance of full information maximum likelihood estimation for missing data in structural equation models. *Structural Equation Modeling: A Multidisciplinary Journal, 8*(3), 430-457.

Evans, J. St. B. T. (2002). Logic and human reasoning: An assessment of the deduction paradigm. *Psychological Bulletin, 128*, 978–996.

Evans, J. St. B. T., & Thompson, V. A. (2004). Informal reasoning: Theory and method. *Canadian Journal of Experimental Psychology, 58*, 69-74.

Exeler, J., & Wild, E. (2003). Die Rolle des Elternhauses für die Förderung selbstbestimmten Lernens. *Unterrichtswissenschaft, 1*, 6-22.

Felton, M. (2004). The development of discourse strategies in adolescent argumentation. *Cognitive Development, 19*, 35–52.

Felton, M., & Kuhn, D. (2001). The development of argumentative discourse skills. *Discourse Processes, 32*, 135–153.

Fitzpatrick, M. A., & Ritchie, L. D. (1994). Communication schemata within the family: Multiple perspectives on family interaction. *Human Communication Research, 20*, 275-301.

Fitzpatrick, M. A., & Koerner, A. F. (1996, July). Family communication schemata and social functions of communication. Paper presented at the International Research Colloquium on Communication Research, Moscow, Russia.

Fletcher, A. C., Darling, N. E., Steinberg, L., & Dornbusch, S. M. (1995). The company they keep: Relation of adolescents' adjustment and behavior to their friends' perceptions of authoritative parenting in the social network. *Developmental Psychology, 31*(2), 300-310.

Frodi, A., Bridges, L., & Grolnick, W. (1985). Correlates of mastery-related behavior: A short-term longitudinal study of infants in their second year. *Child Development, 56*, 1291-1298.

Galotti, K. M. (1989). Approaches to studying formal and everyday reasoning. *Psychological Bulletin, 105*, 331-351.

Gerber, J. (2004). *Intergenerationale Transmission epistemologischer Überzeugungen: Entwicklung eines Erhebungsinstruments und Befunde zur Genese wissensbezogener Vorstellungen.* Bielefeld (Germany): Bielefeld University.

Golding, K. (2000). Parent management training as an intervention to promote adequate parenting. *Clinical Child Psychology and Psychiatry, 5*(3), 357-371.

Goldstein, M., Crowell, A., & Kuhn, D. (2009). What constitutes skilled argumentation and how does it develop? *Informal Logic, 29*(4), 379-395.

Gray, M. R., & Steinberg, L. (1999). Unpacking authoritative parenting: reassessing a multidimensional construct. *Journal of Marriage and Family, 61*(3), 574-587.

Greene, J. A., Azevedo, R., & Torney-Purta, J. (2008). Modeling epistemic and ontological cognition: Philosophical perspectives and methodological directions. *Educational Psychologist, 43*(3), 142-160.

Greene, J. A., Torney-Purta, J., & Azevedo, R. (2010). Empirical evidence regarding relations among a model of epistemic and ontological cognition, academic performance, and educational level. *Journal of Educational Psychology, 102*(1), 234-255.

Greenspan, S. (2006). Rethinking "harmonious parenting" using a three-factor discipline model. *Child Care in Practice, 12*(1), 5-12.

Grolnick, W. S. (2003). *The psychology of parental control: How well-meant parenting backfires*. Mahwah, NJ: Erlbaum.

Grolnick, W. S., & Ryan, R. M. (1989). Parent styles associated with children's self regulation and competence in schools. *Journal of Educational Psychology*, *81*, 143–154.

Grolnick, W. S., & Slowiaczek, M. L. (1994). Parent involvement in children's schooling: A multidimensional conceptualization and motivational model. *Child Development, 64*, 237-252.

Grolnick, W. S., & Pomerantz, E. M. (2009). Issues and challenges in studying parental control: Toward a new conceptualization. *Child Development Perspectives*, *3*, 165-170.

Grolnick, W. S., Deci, E. L., & Ryan, R. M. (1997). Internalization within the family: The self-determination theory perspective. In J. E. Grusec & L. Kuczynski (Eds.), *Parenting and children's internalization of values* (pp. 135-161). New York: Wiley.

Grolnick, W. S., Frodi, A., & Bridges, L. (1984). Maternal control style and the mastery motivation of one-year-olds. *Infant Mental Health Journal, 5*, 15-23.

Grolnick, W. S., Ryan, R. M., & Deci, E. L. (1991). The inner resources for school achievement: Motivational mediators of children's perceptions of their parents. *Journal of Educational Psychology, 83*, 508-517.

Grolnick, W.S., Gurland, S.T., DeCourcey, W., & Jacob, K. (2002). Antecedents and consequences of mothers' autonomy support: An experimental investigation. *Developmental Psychology, 38*, 143-155.

Guay, F., Ratelle, C.F., & Chanal, J. (2008). Optimal learning in optimal contexts: the role of self-determination in education. *Canadian Psychology, 49*, 233-240.

Hallett, D., Chandler, M. J., & Krettenauer, T. (2002). Disentangling the course of epistemic development: Parsing knowledge by epistemic content. *New Ideas in Psychology, 20,* 285–307.

Harris, P. L., & Koenig, M. A. (2006). Trust in testimony: how children learn about science and religion. *Child Development*, *77*(3), 505-524.

Hart, C. H., Newell, L. D., & Olsen, S. F. (2003). Parenting skills and social/communicative competence in childhood. In J. O. Greene, & B. R. Burleson, *Handbook of communication and social interaction skill* (pp. 753-797). Mahwah, NJ: Erlbaum.

Hicks, M. (2012, January 3). Smarter parenting: Just think about it. *The Washington Times*. Retrieved from http://www.washingtontimes.com/news/2012/jan/3/smarter-parenting-just-think-about-it/?page=all

Hofer, B. (2000). Dimensionality and disciplinary differences in personal epistemology. *Contemporary Educational Psychology, 25*, 378-405.

Hofer, B. K. (2002). Personal epistemology as a psychological and educational construct: An introduction. In B. K. Hofer & P. R. Pintrich (Eds.), *Personal Epistemology. The psychology of beliefs about knowledge and knowing* (pp. 3-14). Mahwah: Erlbaum.

Hofer, B. K. (2004a). Exploring the dimensions of personal epistemology in differing classroom contexts: Student interpretations during the first year of college. *Contemporary Educational Psychology, 29,* 2, 129-163

Hofer, B. K. (2004b). Introduction: Paradigmatic approaches to personal epistemology. *Educational Psychologist, 39*, 1–4.

Hofer, B. K. & Pintrich, P. R. (1997). The Development of Epistemological Theories: Beliefs about Knowledge and Knowing and Their Relation to Learning. *Review of Educational Research*, *67*(1), pp. 88-140.

Hoge, D. R., Petrillo, G. H., & Smith, E. I. (1982). Transmission of religious and social values from parents to teenage children. *Journal of Marriage and Family, 44*(3), 569-580.

Hooper, D., Coughlan, J., & Mullen, M. R. (2008). Structural Equation Modeling: Guidelines for Determining Model Fit. *The Electronic Journal of Business Research Methods,* 6(1), 53 – 60.

Jacobs, J. E., & Klaczynski, P. A. (2002). The development of judgment and decision making during childhood and adolescence. *Current Directions in Psychological Science, 11*, 145-149.

Jehng, J. J., Johnson, S.D., & Anderson, R. C. (1993). Schooling and students' epistemological beliefs about learning. *Contemporary Educational Psychology, 18,* 23–35.

Jime´nez-Aleixandre, M. P., Rodrı´guez, A. B., & Duschl, R. A. (2000). ''Doing the lesson'' or ''doing science:'' Argument in high school genetics. *Science Education, 84*, 757–792.

Joussemet, M., Landry, R., & Koestner, R. (2008). A self-determination theory perspective on parenting. *Canadian Psychology, 49*(3), 194-200.

Joussemet, M., Koestner, R., Lekes, N., & Houlfort, N. (2004). Introducing uninteresting tasks to children: A comparison of the effects of rewards and autonomy support. *Journal of Personality*, *72*, 140-166.

Joussemet, M., Koestner, R., Lekes, N., & Landry, R. (2005). A longitudinal study of the relationship of maternal autonomy support to children's adjustment and achievement in school. *Journal of Personality*, *73*, 1215-1235.

Karavasilis, L., Doyle, A. B., & Markiewicz, D. (2003). Associations between parenting style and attachment to mother in middle childhood and adolescence. *International Journal of Behavioral Development, 27*(2), 153-164.

Kardash, C. M., & Wood, P. (2000). *An individual item factoring of epistemological beliefs as measured by self-reporting surveys*. Paper presented at the American Educational Research Association, New Orleans, LA. In Schommer-Aikins, 2004.

Kerr, M., & Stattin, H. (2000). What parents know, how they know it, and several forms of adolescent adjustment: Further support for a reinterpretation of monitoring. *Developmental Psychology, 36*, 366 – 380

King, P. M., & Kitchener, K. S. (1994). *Developing reflective judgment: Understanding and promoting intellectual growth and critical thinking in adolescents and adults*. San Francisco: Jossey-Bass.

King, P. M., & Kitchener, K. S. (2002). The reflective judgment model: Twenty years of research on epistemic cognition. In B. K. Hofer and P. R. Pintrich (Eds.), *Personal epistemology: The psychology of beliefs about knowledge and knowing*, (pp. 37-61). Mahwah, NJ: Lawrence Erlbaum, Publisher.

King, P. M., & Kitchener, K. S. (2004). Reflective judgment: Theory and research on the development of epistemic assumptions through adulthood. *Educational Psychologist, 39*, 5–18.

King, P. M., Wood, P. K., & Mines, R. A. (1990). Critical thinking among college and graduate students. *The Review of Higher Education*, *13*, 167–186.

Kitchener, R. (2002). Folk epistemology: An introduction. *New Ideas in Psychology, 20*, 89–105.

Kline, R. B. (2011). *Principles and Practice of Structural Equation Modeling (3rd Edition)*. New York: The Guilford Press.

Kochanska, G. (1997). Mutually responsive orientation between mothers and their young children: implications for early socialization. *Child Development, 68*, 94-112.

Kochanska, G., & Aksan, N. (1995). Mother-child mutually positive affect, the quality of child compliance to requests and prohibitions, and maternal control as correlates of early internalization. *Child Development, 66,* 236-254.

Kochanska, G., & Aksan, N. (2006). Children's conscience and self-regulation. *Journal of Personality, 74*, 1587-1617.

Kochanska, G., Coy, K.C., & Murray, K. T. (2001). The development of self-regulation in the first four years of life. *Child Development, 72,* 1091-1111.

Koerner, A. F. (1995, November). Family communication patterns: Differences in collectivistic and individualistic families. Paper presented at the annual meeting of the Speech Communication Association, San Antonio, TX.

Koerner, A. F., & Fitzpatrick, M. A. (1997, May). You never leave your family in a fight: The impact of families of origins on conflict-behavior in romantic relationships. Paper presented at the annual meeting of the International Communication Association, Montreal, Canada.

Koerner, A., & Fitzpatrick, M. A. (2002). Understanding family communication patterns and family functioning: the roles of conversation orientation and conformity orientation. In W. B. Gudykunst, *Communication Yearbook 26* (pp. 36-68). Mahwah, NJ: Lawrence Erlbaum Associates.

Koestner, R., Ryan, R. M., Bernieri, F., & Holt, K. (1984). Setting limits on children's behavior: The differential effects of controlling versus informational styles on children's intrinsic motivation and creativity. *Journal of Personality*, *54*, 233-248.

Kortland, K. (1996). An STS case study about students' decision making on the waste issue. *Science Education, 80*, 673–689.

Kolstø, S.D. (2001). To trust or not to trust...—pupils' ways of judging information encountered in a socio-scientific issue. *International Journal of Science Education, 23*, 877–901.

Kuhn, D. (1989). Children and adults as intuitive scientists. *Psychological Review, 96*, 674–689.

Kuhn, D. (1991). *The skills of argument*. Cambridge, UK: Cambridge University Press.

Kuhn, D. (2000). Metacognitive development. *Current Directions in Psychological Science, 9*(5), 178-181.

Kuhn, D. (2005). *Education for thinking*. Harvard University Press.

Kuhn, D., & DeFuccio, M. (2002). Teaching thinking among incarcerated youth. Unpublished manuscript, Teachers College Columbia University.

Kuhn, D., & Pearsall, S. (2000). Developmental origins of scientific thinking. *Journal of Cognition and Development, 1*, 113-129.

Kuhn, D., & Udell, W. (2003). The development of argument skills. *Child Development, 74*, 1245 – 1260.

Kuhn, D., & Weinstock, M. (2002). What is epistemological thinking and why does it matter? In B. K. Hofer & P. R. Pintrich (Eds.), *Personal epistemology: The psychology of beliefs about knowledge and knowing* (pp. 121–144.). Mahwah, NJ: Erlbaum.

Kuhn, D., Amsel, E., & O'Loughlin, M. (1988). *The development of scientific thinking skills*. Orlando, FL: Academic Press.

Kuhn, D., Cheney, R., & Weinstock, M. (2000). The development of epistemological understanding. *Cognitive Development, 15,* 309–328.

Kuhn, D., Iordanou, K., Pease, M., & Wirkala, C. (2008). Beyond control of variables: What needs to develop to achieve skilled scientific thinking? *Cognitive Development, 23,* 435–451.

Kurdek, L. A., & Fine, M. A. (1994). Family acceptance and family control as predictors of adjustment in young adolescents: linear, curvilinear, or interactive effects? *Child Development, 65*, 1137-1146.

Kurdek, L. A., Fine, M. A., & Sinclair, R. J. (1995). School adjustment in sixth graders: Parenting transitions, family climate and peer norm effects. *Child Development, 66*, 430-445.

Ladd, G. W., Profilet, S. M., & Hart, C. H. (1992). Parents' management of children's peer relations: Facilitating and supervising children's activities in the peer culture. In R. D. Parke & G. W. Ladd (Eds.), *Family peer relationships: Modes of linkage* (pp . 215-253). Hillsdale, NJ: Erlbaum.

Lamborn, S. D., Mounts, N. S., Steinberg, L., & Dornbusch, S. M. (1991). Patterns of competence and adjustment among adolescents from authoritative, authoritarian, indulgent, and neglectful families. *Child Development,* 62, 1049-1065.

Leung, K., Lau, S., & Lam, W. L. (1998). Parenting styles and academic achievement: A cross-cultural study. *Merrill-Palmer Quarterly, 44*, 157-172.

Lewis, C. C. (1981). The effects of parental firm control: A reinterpretation of the findings. *Psychological Bulletin, 90*, 547-563.

Lorenz, F., & Wild, E. (2007) Parental involvement in schooling – results concerning its structure and impact on students´ motivation. In M. Prenzel & L. Allolio-Näcke (Eds.), *Studies on the educational quality of schools. The final report on the DFG Priority Programme* (pp. 299-316). Münster: Waxmann.

Maccoby, E., & Martin, J. (1983). Socialization in the context of the family: Parent-child interaction. In E.M. Hetherington (Ed.), P.H. Mussen (Series Ed.), *Handbook of child psychology: Vol. 4. Socialization, personality and social development* (pp. 1-101). New York: Wiley.

Markman, A. (2012). *Smart Thinking: Three Essential Keys to Solve Problems, Innovate, and Get Things Done*. New York: Perigee Trade.

Mason, L., & Scirica F. (2006). Prediction of students' argumentation skills about controversial topics by epistemological understanding. *Learning and Instruction, 16*(5), 492-509.

Means, M. L., & Voss, J. F. (1996). Who reasons well? Two studies of informal reasoning among children of different grade, ability, and knowledge levels. *Cognition and Instruction, 14*(2), 139-178.

Meins, E. (1997). Security of attachment and maternal tutoring strategies: Interaction within the zone of proximal development. *British Journal of Developmental Psychology, 15*, 129–144.

Meins, E., Fernyhough, C., Fradley, E., & Tuckey, M. (2001). Rethinking maternal sensitivity: mothers' comments on infants' mental processes predict security of attachment at 12 months. *Journal of Child Psychology and Psychiatry, 42*(5), 637-648.

Metz, K. E. (2004). Children's understanding of scientific inquiry: Their conceptualization of uncertainty in investigations of their own design. *Cognition and Instruction, 22*, 219–290.

Miller, S., & Sambell, K. (2003). What do parents feel they need? Implications of parents' perspectives for the facilitation of parenting programmes. *Children and Society, 17*, 32-44.

Moshman, D. (1994): Reasoning, metareasoning, and the promotion of rationality; in A. Demetriou & A. Efklides (Eds.), *Intelligence, mind, and reasoning: structure and development* (pp. 135–150). Amsterdam: Elsevier.

Muis, K. R., Bendixen, L. D., & Haerle, F. C. (2006). Domain-generality and domain-specificity in personal epistemology research: Philosophical and empirical reflections in the development of a theoretical framework. *Educational Psychology Review, 18*(1), 3-54.

Oaksford, M., Chater, N., & Hahn, U. (2008). Human reasoning and argumentation: The probabilistic approach. In J. Adler & L. Rips (Eds.), *Reasoning: Studies of human inference and its foundations*. New York: Cambridge University Press.

Orsolini, M. (1993). ''Dwarfs don't shoot'': An analysis of children's justifications. *Cognition and Instruction, 11*, 281 – 297.

Pasquini, E. S., Corriveau, K. H., Koenig, M., & Harris, P. L. (2007). Preschoolers monitor the relative accuracy of informants. *Developmental Psychology, 43*(5), 1216-1226.

Perkins, D. N., Faraday, M., & Bushey, B. (1991). Everyday reasoning and the roots of intelligence. In J. F. Voss, D. N. Perkins, & J. Segal (Eds.), *Informal reasoning and education* (pp. 83-105). Hillsdale, NJ: Lawrence Erlbaum Associates.

Perry, W. G. (1970). *Forms of intellectual and ethical development in the college years: A scheme*. New York: Holt, Rinehart and Winston.

Profilet, S. M., & Ladd, G. W. (1996, April). Relations between maternal consulting about kindergarten children's peer relationships and children's peer competence. *Paper presented at the annual meeting of the American Educational Research Association, New York*.

Ricco, R., & Rodriguez, P. (2006). The relation of personal epistemology to parenting style and goal orientation in college mothers. *Social Psychology of Education, 9*(2), 159-178.

Ross, H. S., Filyer, R. E., Lollis, S. P., Perlman, M., & Martin, J. (1994). Administering justice in the family. *Journal of Family Psychology, 8,* 254–273.

Roth, G., Assor, A., Niemiec, C. P., Ryan, R. M., & Deci, E. L. (2009). The emotional and academic consequences of parental conditional regard: Comparing conditional positive regard, conditional negative regard, and autonomy support as parenting practices. *Developmental Psychology*, *45*, 1119–1142.

Ruddick, S. (1989). *Maternal Thinking*. Boston, Massachusetts: Beacon Press.

Ryan, R. M. (1982). Control and information in the interpersonal sphere: an extension of cognitive evaluation theory. *Journal of Personality and Social Psychology, 43,* 450-461.

Ryan, R. M. (1995). Psychological needs and the facilitation of integrative processes. *Journal of Personality*, *63*, 397–427.

Ryan, R. M., Deci, E. L., Grolnick, W. S., & La Guardia, J. G. (2006). The significance of autonomy and autonomy support in psychological development and psychopathology. In D. Cicchetti & D. J. Cohen (Eds.), *Developmental psychopathology: Theory and method* 2nd ed. (pp. 795-849). New Jersey: John Wiley & Sons, Inc..

Sameroff, A., & Seifer, R. (1983). Familial risk and child competence. *Child Development*, *54*, 1254–1268.

Sadler, T. (2004). Informal reasoning regarding socio scientific issues: A critical review of research. *Journal of Research in Science Teaching, 41* (5), 513-536

Schaefer, E. S. (1965). Children's reports of parental behavior: an inventory. *Child Development, 36*, 413-424.

Schaefer, R. (1968). *Aspects of internalization*. New York: International Universities Press.

Schommer, M. (1990). Effects of beliefs about the nature of knowledge on comprehension. *Journal of Educational Psychology, 82,* 398–504.

Schommer, M. (1993). Epistemological development and academic performance among secondary students. *Journal of Educational Psychology, 85*(3), 406–411.

Schommer, M. (1994). An emerging conceptualization of epistemological beliefs and their role in learning. In R. Garner & P. A. Alexander (Eds.), *Beliefs about text and instruction with text* (pp. 26-40). Hillsdale: Erlbaum.

Schommer, M. (1998), The influence of age and education on epistemological beliefs. *British Journal of Educational Psychology, 68*: 551–562.

Schommer-Aikins, M. (2004). Explaining the epistemological belief system: Introducing the embedded systemic model and coordinated research approach. *Educational Psychologist, 39*(1), 19-29.

Schommer, M., & Hutter, R. (1995). The relationship between epistemological beliefs and controversial day-to-day issues. *Paper presented at the annual meeting of the American Educational Research Association, San Francisco*.

Schomer, M., & Walker, K. (1995) Are epistemological beliefs similar across domains? *Journal of Educational Psychology*, *87*(3), 424–432.

Schommer, M., Crouse, A., & Rhodes, N. (1992). Epistemological beliefs and mathematical text comprehension: Believing it is simple does not make it so. *Journal of Educational Psychology, 84*, 435–443.

Schommer-Aikins, M., Duell, P. K., & Barker, S. (2003). Epistemological beliefs across domains using Biglan's classification of academic disciplines. *Research in Higher Education, 44*(3), 347-366.

Schommer-Aikins, M., Brookhart, S., Hutter, R., & Mau, W. (2000). Understanding middle-school students' beliefs about knowledge and learning using a multidimensional paradigm. *The Journal of Educational Research, 94*, 120–127.

Schraw, G. (2001). Promoting general metacognitive awareness. In H. Hartman (Ed.), *Metacognition in learning and instruction: Theory, research and practice* (pp. 33-68). Dordrecht, Netherlands: Kluwer Academic Publishers.

Schraw, G., Bendixen, L. D., & Dunkle, M. E. (2002). Development and validation of the epistemic belief inventory (EBI). In B. K. Hofer & P. R. Pintrich (Eds.), *Personal epistemology: The psychology of beliefs about knowledge and knowing* (pp. 261–275). Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

Sen, A. K. (1985). Well-being, agency and freedom: the Dewey lectures 1984. *The Journal of Philosophy, 82*(4), 169-221.

Silk, J. S., Morris, A. S., Kanaya, T., & Steinberg, L. (2003). Psychological control and autonomy granting: opposite ends of a continuum or distinct constructs. *Journal of Research on Adolescence, 13*(1), 113-128.

Simon, H. A. (1973). Does scientific discovery have a logic? *Philosophy of Science*, *40*, 471-480.

Skinner, E., Johnson, S., & Snyder, T. (2005). Six dimensions of parenting: a motivational model. *Parenting: Science and Practice, 5*, 175-235.

Soenens, B., & Vansteenkiste, M. (2005). Antecedents and outcomes of self-determination in 3 life domains: the role of parents' and teachers' autonomy support. *Journal of Youth and Adolescence, 34*(6), 589-604.

Soenens, B., & Vansteenkiste, M. (2010). A theoretical upgrade of the concept of parental psychological control: Proposing new insights on the basis of self-determination theory. *Developmental Review, 30,* 74-99.

Soenens, B., Vansteenkiste, M., Lens, W., Luyckx, K., Goossens, L., Beyers, W., & Ryan, R. M. (2007). Conceptualizing parental autonomy support: adolescent perceptions of promotion of independence versus promotion of volitional functioning. *Developmental Psychology, 43*(3), 633-646.

Stage, F. K., Carter, H. C., & Nora, A. (2004) Path analysis: an introduction and analysis of a decade of research. *The Journal of Educational Research, 98*(1), 5-12.

Stattin, H., & Kerr, M. (2000). Parental monitoring: A reinterpretation. *Child Development, 71,* 1072 – 1085.

Stein, N. L., & Albro, E. R. (2001). The origins and nature of arguments: Studies in Conflict Understanding, emotion, and negotiation. *Discourse Processes, 32*(2-3), 113-133.

Stein, N. L., & Miller, C. A. (1991). I win—you lose: The development of argumentative thinking. In J. F. Voss, D. N. Perkins, & J. W. Segal (Eds.), *Informal reasoning and education* (pp. 265–290). Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.

Steinberg, L. (1990). Interdependence in the family: Autonomy, conflict, and harmony in the parent-adolescent relationship. In S. S. Feldman & G. R. Elliott (Eds.), *At the threshold: The developing adolescent* (pp. 255-276). Cambridge, MA: Harvard University Press

Steinberg, L. (2001). We know some things: Parent-adolescent relationships in retrospect and prospect. *Journal of Research on Adolescence, 11*(1), 1-19.

Steinberg, L., Blatt-Eisengart, I., & Cauffman, E. (2006). Patterns of competence and adjustment among adolescents from authoritative, authoritarian, indulgent, and neglectful homes: A replication in a sample of serious juvenile offenders. *Journal of Research on Adolescence, 16*(1), 47-58.

Steinberg, L., Elmen, J., & Mounts, N. (1989). Authoritative parenting, psychosocial maturity, and academic success among adolescents. *Child Development, 60*, 1424-1436.

Steinberg, L., Lamborn, S. D., Dornbusch, S. M., & Darling, N. (1992). Impact of parenting practices on adolescent achievement: authoritative parenting, school involvement and school encouragement to succeed. *Child Development*, *63*, 1266-1281.

Steinberg, L., Lamborn, S., Darling, N., Mounts, N. & Dornbusch, S. (1994). Over-time changes in adjustment and competence among adolescents from authoritative, authoritarian, indulgent, and neglectful families. *Child Development*, *65*, 754-770.

Symonds, P. M. (1939). *The psychology of parent-child relationships*. New York: Appleton-Century-Crofts.

Steinberg, L., Mounts, N., Lamborn, S., & Dornbusch, S. (1991). Authoritative parenting and adolescent adjustment across various ecological niches. *Journal of Research on Adolescence, 1*, 19-36.

Tesla, C., & Dunn, J. (1992). Getting along or getting your own way: The development of young children's use of argument in conflicts with mother and sibling. *Social Development, 1*, 107–121.

Udell, W. (2007). Enhancing adolescent girls' argument skills in reasoning about personal and non-personal decisions. *Cognitive Development, 22*, 341-352.

Vallerand, R. J., Fortier, M. S., & Guay, F. (1997). Self-determination and persistence in a real-life setting: Toward a motivational model of high school dropout. *Journal of Personality and Social Psychology, 72*, 1161-1176.

Vuchinich, S., Vuchinich, R. A., & Coughlin, C. (1992). Family talk and parent–child relationships: Toward integrating deductive and inductive paradigms. *Merrill-Palmer Quarterly, 38,* 69–93.

Wang, Q., Pomerantz, E. M., & Chen, H. C. (2007). The role of parents' control in early adolescents' psychological functioning: A longitudinal investigation in the United States and China. *Child Development, 78,* 1592–1610.

Weinstock, M., & Cronin, M. (2003). The everyday production of knowledge: Individual differences in epistemological understanding and juror-reasoning skill. *Applied Cognitive Psychology, 17*, 161–181.

Weinstock, M.P., Neuman, Y., & Glassner, A. (2006). Identification of informal reasoning fallacies as a function of epistemological level, grade level, and cognitive ability. *Journal of Educational Psychology, 98*, 327-341.

Wild, E., & Wild, K. P. (1997). Familiale Sozialisation und schulische Lernmotivation. *Zeitschrift für Pädagogik, 43*, 55-77.

Woll, S. (2002). *Everyday thinking: Memory, reasoning, and judgment in the real world*. Mahwah, NJ: Lawrence Erlbaum.

Wood, P. K., & Kardash, C. A. (2002). Critical elements in the design and analysis of studies of epistemology. In B. K. Hofer & Paul R. Pintrich (Eds.), *Personal epistemology: The psychology of beliefs about knowledge and knowing* (pp. 231–260). Mahwah, NJ: Erlbaum.

Yang, F. Y., & Tsai, C. C. (2009). Reasoning about science-related uncertain issues and epistemological perspectives among children. *Instructional Science, 38*(4), 325-354.

Zimmerman, C. (2000). The development of scientific reasoning skills. *Developmental Review, 20*, 99–149.

Zimmerman, C. (2007). The development of scientific thinking skills in elementary and middle school. *Developmental Review*, *27*, 172-223.

Zohar, A., & Nemet, F. (2002). Fostering students' knowledge and argumentation skills through dilemmas in human genetics. *Journal of Research in Science Teaching, 39*, 35 – 62.

APPENDIX

Scale 1: Parenting Scale (Wild, 1999)

Dimension 1: Autonomy-support (11 items)

Items in German	**Items in English**
Wie werden bei Euch zu Hause Entscheidungen getroffen und Dinge besprochen?	How are decisions made and things discussed in your home?
Wenn wir zu Hause beratschlagen, was wir am Wochenende oder im Urlaub machen, gehen meine Eltern auf meine Vorschläge ein.	When we discuss at home what to do on weekends or vacations, my parents use my suggestions.
Meinen Eltern finden es gut, wenn ich meine Meinung sage.	My parents find it good when I voice my opinions.
Wenn ich mir etwas wünsche und nicht bekomme, erklären mir meine Eltern, warum.	When I wish for something and do not get it, my parents explain the reasons why.
Meine Eltern frage mich oft nach meiner Meinung.	My parents often ask for my opinion.
Wenn meine Eltern etwas von mir wollen, erklären sie mir auch warum.	When my parents want something from me, they explain to me the reasons for doing so.
Meine Eltern lassen mich selbst Pläne für die Dinge machen, die ich tun will.	My parents even let me make plans for the things I want to do.
Meine Eltern ermutigen mich, ...	My parents encourage me...
... ganz alleine zu entscheiden, wofür ich mein Taschengeld ausgebe.	.. to decide on my own what I spend my pocket money on.
... darüber nachzudenken, was ich am Fernsehen sehen möchte.	... to think about what I want to see on television.
... darüber nachzudenken, wohin ich in den Ferien fahren möchte.	... to think about where I want to go for holidays.
... auch mal alleine zu Verwandten und Freunden zu fahren.	... to also make time to see relatives and friends by myself.
... mir beim Einkaufen meine Kleider selbst auszusuchen.	... to pick my own clothes when shopping.

Dimension 2: Responsiveness (6 items)

Wie ist das Verhältnis zu euren Eltern?	How is your relationship or rapport with your parents?
Zu meinen Eltern habe ich vollstes Vertrauen.	I have full trust in my parents.
Meine Eltern kümmern sich um mich, wenn ich Probleme habe.	My parents care for me when I have problems.
Meine Eltern kennen meine Freunde.	My parents know my friends.
Meine Eltern nehmen sich Zeit, wenn ich etwas mit ihnen bereden möchte.	My parents make time for me when I want to talk to them about something.
Ich kann mit meinen Eltern offen darüber reden, was ich denke und wie ich mich fühle.	I can openly share with my parents what I think and how I feel.
Meine Eltern wissen oft, was ich denke und wie ich mich fühle.	My parents often know what I think and how I feel.

Dimension 3: Control (6 items)

Wie streng sind eure Eltern?	How strict are your parents?
Wenn ich etwas tun möchte, was Ihnen nicht gefällt, verbieten sie es mir einfach.	When I want to do something that my parents do not like, they forbid me to do so.
Wenn ich nicht sofort tue, was sie mir sagen, dann gibt`s ein Donnerwetter.	When I do not immediately do what my parents say, huge arguments occur.
Meine Eltern sagen häufig: ``Das wirst du verstehen, wenn du erwachsen bist.“	My parents frequently say: ``You will understand when you grow up.”
Bei schlechten Noten machen mir meine Eltern schon mal das Leben schwer.	With bad grades, my parents make my life difficult.
Meine Eltern meinen, in Auseinandersetzungen sollte ich eher zurückstecken, als andere Leute ärgerlich zu machen.	My parents think I should back down in disputes rather than to make other people angry.
Meine Eltern wollen, dass ich ihnen sofort gehorche.	My parents want me to obey them immediately.

Dimension 4: Structure (11 items)

Wie sieht euer Familienalltag aus?	How does your family's everyday life look like?
Es gibt Zeitbeschränkungen für meine Freizeitbeschäftigungen (z.B. Fernsehen, draußen spielen).	There are time restrictions for my free time (e.g. Watching television, playing outside).
Jedes Familienmitglied ist bei uns für bestimmte Aufgaben im Haushalt verantwortlich (z.B. Müll rausbringen, abwaschen).	Each family member is responsible for certain tasks in the household (e.g. Bringing out the garbage, washing up).
Bei uns weiß jeder, wer wann welche Dinge zu erledigen hat.	With us, everyone knows who, when and what things to do.
Ich denke, ich weiß, was meine Eltern gut finden und was nicht.	I think I know what my parents find good and what not.
Wenn mir meine Eltern etwas nicht erlauben wollen, lassen sie sich von mir auch nicht herumkriegen.	When my parents do not allow something, they cannot be won over in any way.
Wenn mir meine Eltern etwas verbieten und ich bettele eine Weile, erlauben sie es schließich doch.	When my parents forbid something and I beg for awhile, they allow it in the end.
Wenn meine Eltern sagen, dass ich ins Bett gehen muss, bringe ich sie leicht dazu, dass ich noch länger aufbleiben darf.	When my parents say that I must go to bed, I bring light to the fact that I still may stay up longer.
Wenn ich meinen Eltern nur lange genug etwas vorjammere, geben sie schließlich nach.	If I moan or gripe about something long enough to my parents, in the end they give in to it.
Wenn meine Eltern mir einmal etwas verbieten, bleiben sie dabei und erlauben es mir auch später nicht.	When my parents forbid something once, they stay with that decision and also will not allow it later.
Wenn meine Eltern etwas verbieten, kann es sein, dass sie es ein anderes Mal doch erlauben.	When my parents forbid something, it can happen that they allow it some other time.
Wenn mir meine Eltern etwas verbieten, kann ich machen was ich will, sie bleiben dabei.	When my parents forbid something, I can do what I want but they still stay with it.

APPENDIX EXEMPLER OF PARENTING QUESTIONNAIRE USED

	Wie werden bei Euch zu Hause Entscheidungen getroffen und Dinge besprochen?	stimmt gar nicht	stimmt wenig	stimmt ziemlich	stimmt ganz genau
1	Wenn wir zu Hause beratschlagen, was wir am Wochenende oder im Urlaub machen, gehen meine Eltern auf meine Vorschläge ein.	❑	❑	❑	❑
2	Meine Eltern finden es gut, wenn ich meine Meinung sage.	❑	❑	❑	❑
3	Wenn ich mir etwas wünsche und nicht bekomme, erklären mir meine Eltern, warum.	❑	❑	❑	❑
4	Meine Eltern fragen mich oft nach meiner Meinung.	❑	❑	❑	❑
5	Wenn meine Eltern etwas von mir wollen, erklären sie mir auch warum.	❑	❑	❑	❑
6	Meine Eltern lassen mich selbst Pläne für die Dinge machen, die ich tun will.	❑	❑	❑	❑

	Meine Eltern ermutigen mich, …	stimmt gar nicht	stimmt wenig	stimmt ziemlich	stimmt ganz genau
7	… ganz alleine zu entscheiden, wofür ich mein Taschengeld ausgebe.	❑	❑	❑	❑
8	… darüber nachzudenken, was ich im Fernsehen sehen möchte.	❑	❑	❑	❑
9	… darüber nachzudenken, wohin ich in den Ferien fahren möchte.	❑	❑	❑	❑
10	… auch mal alleine zu Verwandten und Freunden zu fahren.	❑	❑	❑	❑
11	… mir beim Einkaufen meine Kleider selbst auszusuchen.	❑	❑	❑	❑

	Wie ist das Verhältnis zu euren Eltern?	stimmt gar nicht	stimmt wenig	stimmt ziemlich	stimmt ganz genau
1	Zu meinen Eltern habe ich vollstes Vertrauen.	❑	❑	❑	❑
2	Meine Eltern kümmern sich um mich, wenn ich Probleme habe.	❑	❑	❑	❑
3	Meine Eltern kennen meine Freunde.	❑	❑	❑	❑
4	Meine Eltern nehmen sich Zeit, wenn ich etwas mit ihnen bereden möchte.	❑	❑	❑	❑
5	Ich kann mit meinen Eltern offen darüber reden, was ich denke und wie ich mich fühle.	❑	❑	❑	❑
6	Meine Eltern wissen oft, was ich denke und wie ich mich fühle.	❑	❑	❑	❑

	Wie streng sind eure Eltern?	stimmt gar nicht	stimmt wenig	stimmt ziemlich	stimmt ganz genau
1	Wenn ich etwas tun möchte, was Ihnen nicht gefällt, verbieten sie es mir einfach.	❑	❑	❑	❑
2	Wenn ich nicht sofort tue, was sie mir sagen, dann gibt´s ein Donnerwetter.	❑	❑	❑	❑
3	Meine Eltern sagen häufig: „Das wirst du verstehen, wenn du erwachsen bist.“	❑	❑	❑	❑
4	Bei schlechten Noten machen mir meine Eltern schon mal das Leben schwer.	❑	❑	❑	❑
5	Meine Eltern meinen, in Auseinandersetzungen sollte ich eher zurückstecken, als andere Leute ärgerlich zu machen.	❑	❑	❑	❑
6	Meine Eltern wollen, dass ich ihnen sofort gehorche.	❑	❑	❑	❑

	Wie sieht euer Familienalltag aus?	stimmt gar nicht	stimmt wenig	stimmt ziemlich	stimmt ganz genau
1	Es gibt Zeitbeschränkungen für meine Freizeitbeschäftigungen (z.B. Fernsehen, draußen spielen).	❑	❑	❑	❑
2	Jedes Familienmitglied ist bei uns für bestimmte Aufgaben im Haushalt verantwortlich (z.B. Müll rausbringen, abwaschen).	❑	❑	❑	❑
3	Bei uns weiß jeder, wer wann welche Dinge zu erledigen hat.	❑	❑	❑	❑
4	Ich denke, ich weiß, was meine Eltern gut finden und was nicht.	❑	❑	❑	❑

	Wie leicht sind eure Eltern zu überreden?	stimmt gar nicht	stimmt wenig	stimmt ziemlich	stimmt ganz genau
1	Wenn mir meine Eltern etwas nicht erlauben wollen, lassen sie sich von mir auch nicht herumkriegen.	❑	❑	❑	❑
2	Wenn mir meine Eltern etwas verbieten und ich bettele eine Weile, erlauben sie es schließlich doch.	❑	❑	❑	❑
3	Wenn meine Eltern sagen, dass ich ins Bett gehen muss, bringe ich sie leicht dazu, dass ich noch länger aufbleiben darf.	❑	❑	❑	❑
4	Wenn ich meinen Eltern nur lange genug etwas vorjammere, geben sie schließlich nach.	❑	❑	❑	❑
5	Wenn meine Eltern mir einmal etwas verbieten, bleiben sie dabei und erlauben es mir auch später nicht.	❑	❑	❑	❑
6	Wenn mir meine Eltern etwas verbieten, kann es sein, dass sie es ein anderes Mal doch erlauben.	❑	❑	❑	❑
7	Wenn mir meine Eltern etwas verbieten, kann ich machen was ich will, sie bleiben dabei.	❑	❑	❑	❑

Scale 2a

Epistemic and Ontological Cognition Questionnaire (EOCQ; Greene et al., 2010)

Simple and Certain Knowledge Items
In (math/history), the truth means different things to different people.
To know (math/history) well, you need to memorize what you are taught.
In (math/history), what is a fact today will be a fact tomorrow.
(Mathematicians'/Historians') knowledge of the facts about math does not change.
(Math/History) is so complex that humans will never really understand it.
Justification by Authority Items
If a (mathematician/historian) says something is a fact, I believe it.
Things written in (math/history) textbooks are true.
I believe everything I learn in (math/history) class.
If a (math/history) teacher says something is a fact, I believe it.
Personal Justification Items
In (math/history), everyone's knowledge can be different because there is no one absolutely right answer.
In (math/history), if you believe something is a fact, no one can prove to you that you are wrong.
In (math/history), what's a fact depends upon a person's point of view.
(Mathematical/Historical) knowledge is all factual and there are no opinions.

Scale 2b
R-EOCQ – Revised Domain-general EOCQ

Simple and Certain Knowledge Items
The truth means different things to different people.
To know a subject well, you need to memorize what you are taught.
What is a fact today will be a fact tomorrow.
An expert's factual knowledge does not change.
Fields of knowledge are so complex that humans will never really understand it.
Justification by Authority Items
If an expert says something is a fact, I believe it.
Things written in textbooks are true.
I do not doubt what I learn in class.
If a teacher says something is a fact, I believe it.
Personal Justification Items
Everyone's knowledge can be different because there is no one absolutely right answer.
If you believe something is a fact, no one can prove to you that you are wrong.
What's a fact depends upon a person's point of view.
Knowledge is all factual and there are no opinions.

APPENDIX EXEMPLER OF EOCQ USED
(Child Version in German)

	Wie beurteilt ihr die folgenden Aussagen?	lehne völlig ab	lehne ziemlich ab	lehne eher ab	stimme eher zu	stimme ziemlich zu	stimme völlig zu
1	Die Wahrheit bedeutet Unterschiedliches für verschiedene Menschen.	❑	❑	❑	❑	❑	❑
2	Um sich in einem Thema auszukennen, musst du wissen was du dazu gelernt hast.	❑	❑	❑	❑	❑	❑
3	Was heute eine Tatsache ist, wird auch morgen eine Tatsache sein.	❑	❑	❑	❑	❑	❑
4	Das Wissen der Experten ändert sich nicht.	❑	❑	❑	❑	❑	❑
5	Wissensgebiete sind so kompliziert, dass Menschen sie nie wirklich verstehen werden.	❑	❑	❑	❑	❑	❑
6	Wenn ein Experte sagt, etwas sei eine Tatsache, habe ich kein Problem, ihm zu glauben.	❑	❑	❑	❑	❑	❑
7	Dinge, die in meinen Schulbüchern stehen, sind richtig.	❑	❑	❑	❑	❑	❑
8	Ich zweifle nicht an, was ich im Unterricht lerne.	❑	❑	❑	❑	❑	❑
9	Wenn mein Lehrer etwas sagt, ist das eine Tatsache und ich glaube es.	❑	❑	❑	❑	❑	❑
10	Das Wissen von jedem kann unterschiedlich sein, da es nicht eine absolut richtige Antwort gibt.	❑	❑	❑	❑	❑	❑
11	Wenn ich glaube, etwas ist richtig, kann mir niemand das Gegenteil beweisen.	❑	❑	❑	❑	❑	❑
12	Es ist von der Meinung einer Person abhängig, was für ihn eine Tatsache ist.	❑	❑	❑	❑	❑	❑
13	Wissen besteht aus Fakten und nicht aus Meinungen.	❑	❑	❑	❑	❑	❑

Scale 2c
German R-EOCQ
Child and Parent Versions

Child Version
1. Die Wahrheit bedeutet Unterschiedliches für verschiedene Menschen.
2. Um sich in einem Thema auszukennen, musst du wissen was du dazu gelernt hast.
3. Was heute eine Tatsache ist, wird auch morgen eine Tatsache sein.
4. Das Wissen der Experten ändert sich nicht.
5. Wissensgebiete sind so komplex, dass Menschen sie nie wirklich verstehen werden.
6. Wenn ein Experte sagt, etwas sei eine Tatsache, habe ich kein Problem, ihm zu glauben.
7. Dinge, die in meinen Schulbüchern stehen, sind richtig.
8. Ich zweifle nicht an, was ich im Unterricht lernen.
9. Wenn mein Lehrer etwas sagt, ist das eine Tatsache und ich glaube es.
10. Das Wissen von jedem kann unterschiedlich sein, da es nicht eine absolut richtige Antwort gibt.
11. Wenn ich glaube, etwas ist richtig, kann mir niemand das Gegenteil beweisen.
12. Es ist von der Meinung einer Person abhängig, was für ihn eine Tatsache ist.
13. Wissen besteht aus Fakten und nicht aus Meinungen.
Parent Version
1. Die Wahrheit bedeutet Unterschiedliches für verschiedene Menschen.
2. Um sich in einem Thema auszukennen, müssen Sie wissen was Sie dazu gelernt haben.
3. Was heute eine Tatsache ist, wird auch morgen eine Tatsache sein.
4. Das Faktenwissen der Experten ändert sich nicht.
5. Wissensgebiete sind so komplex, dass Menschen sie nie wirklich verstehen werden.
6. Wenn ein Experte sagt, etwas sei eine Tatsache, habe ich kein Problem, ihm zu glauben.
7. Dinge, die in meinen Lehrbüchern stehen, sind richtig.
8. Wenn ich in etwas unterrichtet werde, zweifle ich es nicht an.
9. Wenn mein Lehrer, der mich in unterrichtet etwas sagt, ist das eine Tatsache und ich glaube es.
10. Das Wissen von jedem kann unterschiedlich sein, da es nicht eine absolut richtige Antwort gibt.
11. Wenn ich glaube, etwas ist richtig, kann mir niemand das Gegenteil beweisen.
12. Es ist von der Meinung einer Person abhängig, was für Sie eine Tatsache ist.
13. Wissen besteht aus Fakten und nicht aus Meinungen.

Scale 3

Family Communication Patterns Items (Based on the RFCP; Koerner & Fitzpatrick, 2002)

Conversation Orientation (N=11)	
In German	In English
1. Meine Eltern fragen nach meiner Meinung, bevor sie über Familienangelegenheiten entscheiden.	My parents ask for my opinion before family decisions are made.
2. Bei uns werden Dinge erst dann entschieden, nachdem wir sie besprochen haben.	With us decisions are made after we have spoken about it.
3. Ich unterhalte mich gerne mit meinen Eltern über meine Erlebnisse.	I like to speak with my parents about my experiences.
4. Ich kann meinen Eltern fast alles sagen.	I can tell my parents almost everything.
5. Ich erzähle meinen Eltern häufig, was ich so am Tag gemacht und erlebt habe.	I frequently tell my parents what I did and experienced in the day.
6. Meine Eltern begründen ihre Meinungen im Gespräch mit mir.	My parents justify their opinions in conversations with me.
7. Es fällt mir leicht, mit meinen Eltern darüber zu reden, was in mir vorgeht.	It is easy for me to speak with my parents about what is going on within me
8. Es fällt mir leicht, mit meinen Eltern über meine Gefühle zu sprechen.	It is easy for me to speak with my parents about my feelings.
9. Wir sprechen häufig in unsere Familie über Gefühlen.	We speak often about emotions in our family.
Conformity Orientation (N=6)	
In German	In English
10. Meine Eltern erwarten, dass Kinder den Erwachsenen nicht widersprechen sollen.	My parents expect that children should not have conflicts with adults.
11. Meine Eltern erwarten, dass Kinder mit Erwachsenen nicht herum diskutieren sollen.	My parents expect that children should not enter into discussions with adults.
12. Wenn ich mich mit meinen Eltern unterhalte, spreche ich ungern über Dinge, die mich betreffen.	When I talk with my parents, I do not like to talk about things that concern me.
13. Meine Eltern sind an meiner Meinung/Position interessiert, selbst wenn sie nicht mir ihrer übereinstimmt. *(Recoded)*	My parents are interested in my opinion/position even when it does not match with theirs. *(Recoded)*

Appendix 4a
Items for measuring CASMIN (German/English)

Welchen allgemeinen Schulabschluss haben Sie?
What is your general education?

Mutter *Mother*		**Vater** Father
❑	keinen Abschluss Incomplete general education	❑
❑	Hauptschulabschluss Elementary school education	❑
❑	Realschulabschluss / mittlere Reife oder vergleichbares Secondary school education or equivalent	❑
❑	Fachhochschulreife / Fachabitur Technical College/ Technical School	❑
❑	Abitur / allgemeine Hochschulreife High School Leaving certificate/ General University	❑

Welchen beruflichen Ausbildungsabschluss haben Sie?
What degree of vocational training have you received?

Mutter *Mother*		**Vater** Father
❑	keinen beruflichen Abschluss No vocational degree	❑
❑	Berufsabschluss mit gewerblicher od. landwirtschaftlicher Lehre Vocational qualification with industrial or agricultural teaching	❑
❑	Berufsschulabschluss mit kaufmännischer od. sonstiger Lehre Vocational qualification with commercial or other teaching	❑
❑	Berufsfachschulabschluss Vocational qualification	❑
❑	Meister/Techniker od. gleichwertigen Abschluss Craftsman/Engineer or equivalent qualification	❑
❑	Fachhochschulabschluss College Degree	❑
❑	Hochschulabschluss University Degree	❑

Appendix 4b

Comparative Analysis of Social Mobility in Industrial Nations (CASMIN)
German education and vocational training levels (in German Language)

CASMIN-Klassifikation

Levels	*Educational and Vocational description*
1a	Kein Abschluss
1b	Hauptschulabschluss ohne berufliche Ausbildung
1c	Hauptschulabschluss mit beruflicher Ausbildung
2a	Mittlere Reife ohne berufliche Ausbildung
2b	Mittlere Reife mit beruflicher Ausbildung
2c_gen	Fachhochschulreife/Abitur ohne berufliche Ausbildung
2c_voc	Fachhochschulreife/Abitur mit beruflicher Ausbildung
3a	Fachhochschulabschluss
3b	Hochschulabschluss

Appendix 5a

Informal Reasoning Task
First Task - Reason-Evaluation

Tom spoke at recess to a few friends about this matter. They also think that Marie should confess everything. He asks them why they think so. They gave various reasons. How good do you find these reasons? Indicate which reason you find best, the second best, and so on. Give every reason a ranking grade from 1 to 6 and write this in the circles.
Attention: You can only give each ranking grade once! You can cross out the grades on the scale above so that you know which grades you have already given out.

Very good ① ② ③ ④ ⑤ ⑥ Dissatisfied

"Marie should confess. I think that cheating is not good. I think it was bad of Marie to cheat."	○
"It is better for Marie to confess now. Then perhaps the punishment will be lighter. If they find out otherwise, it might be more severe."	○
"Marie should confess what she has done at the painting competition. One of our class rules writes that we should be fair."	○
"Marie should confess that she has broken the rules. A competition must be fair for all. Breaking the rules was unfair."	○
"Marie should confess. A friend of mine cheated in his Math homework once and confessed to that after."	○
"Marie should confess what she has done. Our teachers and parents always say that one should not cheat."	○

Appendix 5b

Informal Reasoning Task
Second Task – Argument-analysis

Tom convinced Marie to confess. They go to their teacher and tell him everything. After which their teacher spoke to the whole class about this incident. As homework all students were to imagine that Marie had not confessed this matter and to write a letter giving her advice on what to do next. Four students read out their letters the next day. Which advice do you find good? Give each letter a grade from 1 (very good) to 4 (satisfactory)! Indicate which advice you find the best, the second best and so on. Attention: You can only give each grade once!

Hello Marie,
Perhaps you should tell the teacher what you have done. But perhaps you should also not tell that you broke the rules. Perhaps you should discuss this matter once more with your friends.
Sincerely, Steffen
Grade: _____

Hello Marie,
What you should do depends on what you think is important. If you think honesty is important, then you should confess that you did not obey the competition rules. If you think that it is more important to keep the prize, then you should not say that you broke the rules of the painting competition. Perhaps you should discuss this matter once more with your friends.
Sincerely, Merve **Grade: _____**

Hello Marie,
What you should do depends on what is important to you. If you think honesty is important, then you should confess. But perhaps you should not do it anymore. If you think that it is more important to keep the prize, naturally you should not confess. But maybe someone will find out. Then you should cheat less. Perhaps you should discuss this matter once more with your friends.
Sincerely, Luca **Grade: _____**

should confess this matter. If you want to keep the prize, naturally you should not confess. Perhaps you should discuss this matter once more with your friends.
Sincerely, Kristina
Grade: _____