Question, explanation, follow-up: a global mechanism for learning from others?

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QUESTION, EXPLANATION, FOLLOW-UP:
A GLOBAL MECHANISM FOR LEARNING FROM OTHERS?

by

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For my parents, whose goal it was to educate their daughters….you did it!
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ABSTRACT

Five studies were conducted examining a pattern of interaction children use as a mechanism for learning from others. The three components of this interaction pattern consisted of children’s questions, adults’ explanations and children’s follow-up. I was interested in how individual differences might influence this interaction pattern. In Study 1, I performed a secondary data analysis to explore the entire pattern of interaction. Analyses revealed that children across diverse socioeconomic groups asked a similar proportion of information seeking questions in daily conversations with caregivers. However, when looking at the responses children received, caregivers from low-SES families offered significantly fewer exemplary responses (those that include explanations) to causal questions than mid-SES caregivers. When exploring the quality of explanations that caregivers offered, low-SES caregivers provided more circular explanations while mid-SES caregivers provided more non-circular explanations. Finally, when exploring children’s follow-up to unsatisfactory responses, no differences were found when looking at fact-based questions. Indeed, children from low-SES and mid-SES families were most likely to re-ask their original question which indicates that children across diverse backgrounds purposely use their questions to acquire new knowledge.
Significant differences were found when looking at follow-up to unsatisfactory responses to causal questions. Mid-SES children were significantly more likely to provide their own explanations. These findings extend previous work and suggest that this interaction pattern may not look the same across diverse backgrounds.

Studies 2, 3 and 4 explored the first half of this interaction pattern: questions and adult explanations. Here I focused on 3- and 5-year-olds’ evaluation of non-circular and circular explanations, and their use of such explanations to determine informant credibility. Whereas 5-year-olds demonstrated a selective preference for non-circular over circular explanations (Study 2: long explanations; Study 3: short explanations), 3-year-olds only demonstrated a preference for the non-circular when the explanations were shortened (Study 3). Children’s evaluation of the explanations extended to their inferences about the informants’ future credibility. Both age groups demonstrated a selective preference for learning novel explanations from an informant who had previously provided non-circular explanations – although only 5-year-olds also preferred to learn novel labels from her. However, when looking at individual differences in these preferences by socioeconomic status (Study 4) children from low-SES families selectively preferred informants who provided circular explanations, whereas mid-SES children showed a preference for non-circular explanations.

Study 5 explored the second half of the interaction pattern: adult explanations and children’s follow-up. Here I explored individual differences in epistemological beliefs and their impact on caregiver’s explanations and children’s subsequent learning. Epistemological stance predicted children’s learning. Children of caregivers who adopted
an evaluativist stance learned more than children of caregivers who used an absolutist stance.

Taken together, these results have the potential to inform caregivers, daycare providers and classroom teachers about the importance of the responses they offer to children’s questions. These responses are integral to the question, explanation, follow-up pattern of interaction that children use when acquiring new knowledge from others. Understanding how individual differences impact this interaction pattern may help decrease cognitive disparities between children across sociocultural contexts before the onset of formal schooling.
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Chapter 1: Literature Review

Introduction

Currently in the United States, 22% of all children live in families with incomes below the federal poverty level (NCCP, 2014). These children are less likely to have access to early educational opportunities (e.g., high-quality preschools) that are necessary for the development of the knowledge and skills needed for academic success (Nores & Barnett, 2014). Indeed, by the time children enter formal schooling, children from low-socioeconomic status (SES) families are at a significant academic disadvantage, as compared to children from mid- and high-SES families (Hart & Risley, 1992; Hart & Risley, 1995). Given that vocabulary at kindergarten is a significant predictor of academic achievement in later grades (Cunningham & Stanovich, 1997), the majority of research to date examining SES differences has focused on language development and discrepancies in children’s vocabulary and comprehension (e.g., Halle et al., 2009; Hart & Risley, 1995; Fernald, Marchman & Weisleder, 2013; Lee & Burkam, 2002). Recent research has found SES-based deficits in vocabulary by 18 months. These deficits increase during the preschool years, with a 6-month gap found by age 2 between low-SES and mid-SES children, and as much as a 2-year gap in language by age 5 (Fernald, Marchman & Weisleder, 2013).

In the following chapters, I argue that it is unlikely that vocabulary differences are the only cognitive disadvantage that children from low-SES families face when they enter formal schooling. Specifically, I suggest that there might be differences in children’s use of questions to solicit information, in the quality of their interlocutor’s explanation, and in children’s subsequent use of the explanation. These
differences may cause children to acquire less information about the world, potentially causing differences in children’s knowledge by the time they enter Kindergarten.

When children enter formal schooling they are often confronted with ‘academic language’ and specific patterns of interaction that may not be synonymous with the patterns of interaction used for learning in the home (Snow & Uccelli, 2009). For example, schools often privilege a pattern of interaction whereby children are expected to ask questions and use the explanations provided by teachers for learning (e.g., inquiry-based, query method, Socratic method etc.) This question-explanation pattern of interaction may not be familiar to all children. Indeed, in a recent study, we found that mid-SES preschoolers show a preference for more complex explanations, whereas low-SES preschoolers prefer less complex explanations (Corriveau & Kurkul, 2013), suggesting that children from mid-SES families may be exposed to more high-quality explanations. This may be linked to if and how children from diverse backgrounds use questions that elicit explanations for learning. This is potentially problematic, given that complex explanatory structures are found in the ‘academic language’ (Snow & Uccelli, 2009) used in formal schooling and we have come to expect that by the time ALL children enter formal schooling they prefer to learn from complex explanations potentially making it difficult for children to negotiate the classroom setting and to interact appropriately with teachers.

An understanding of the variability in the early interaction patterns children use when learning from others is essential in creating high-quality learning environments that are accessible to all children. Indeed, President Obama emphasized the need for high-
quality early education in his 2013 State of the Union address, in part as an attempt to reduce such large academic inequities even before the start of formal schooling. The goal of this dissertation is to examine individual differences in children’s questions, adult’s explanations, and the child’s follow-up to the adult’s explanations. More broadly, I am interested in how this process is related to the child’s school readiness abilities in order to inform educational policy.

Children’s early learning experiences are largely shaped by their interactions with the social world (Vygotsky, 1978). Some of these learning experiences are around mundane problems, such as how to find a missing object, whereas others are more complex, such as understanding buoyancy (e.g., sink vs. float activities). Some of these problems can be solved using previous knowledge that the child already possesses, or through exploration and experiential learning, whereas others depend on the child’s ability to actively seek information from external sources. When children learn, they have access to two sources of information: their own, first-hand experience and the information provided by others. Although most research in developmental psychology and education focuses on first-hand exploration (e.g. Duckworth, 1972; Gopnik & Meltzoff, 1997; Piaget, 1929), solitary real-world exploration often does not provide full access to abstract concepts, absent or invisible referents, many scientific phenomena, or future events. To fully learn about such concepts, children must rely on information provided by others (Bruner, 2009; Vygotsky, 1978; Nelson, 1996).

Moreover, such information is not always spontaneously provided by others. Instead, children often use question-asking as a mechanism for acquiring new
information that cannot be learned through first-hand experiences (Callanan & Oakes, 1992; Hickling & Wellman, 2001). Indeed, by the time children enter preschool, they ask an average of 76 information-seeking questions per hour (Chouinard, 2007) and by the age of 5 they, they are able to formulate effective questions to acquire the knowledge they need to learn a new concept (Mills, Legare, Bills & Mejias, 2010). Many of these questions require simple-one-word answers, while others require more complex explanations. (e.g., ‘how’ and ‘why’ questions). Arguably, both the content and the quality of these explanations play a critical role in shaping early learning. On the one hand, explanations can provide children with vocabulary rich interactions that contribute to school readiness (Hart & Risley, 1995). On the other hand, explanations provide critical information for understanding new concepts that cannot be acquired through first-hand observations (Frazier, Welman & Gelman, 2009).

Despite the critical role explanations play in providing young children with the necessary information to acquire new concepts, adults do not always provide high-quality explanations. Indeed, some caregivers simply do not have the necessary knowledge to offer an appropriate explanation to their child’s question or the time needed to formulate a high-quality explanation, and do not always feel it is necessary/appropriate to provide children with complex responses to their inquiries (Valle, 2009). This often leads caregivers to ignore a question or to offer an ineffective response such as “it is because it is.” In contrast, high-quality explanations are often elaborate and complex and avoid circular logic. Moreover, these types of explanations often provide children with more opportunities to ask questions. Many factors may contribute to differences in the quality
of explanations children are exposed to. Specifically, different patterns of talk such as children’s use of questions to elicit explanations from caregivers may differ across socioeconomic (SES) groups, providing more or less opportunities for high-quality explanations.

These differences may be potentially problematic for formal schooling where a pattern of interaction whereby children are expected to ask questions and use the explanations provided by teachers for learning is often privileged (Schultz, 2009). This question-explanation pattern of interaction may not be familiar to all children. Indeed, in a recent study, we found that mid-SES preschoolers show a preference for more complex explanations, whereas low-SES preschoolers prefer less complex explanations (Corriveau & Kurkul, in prep), suggesting that children from mid-SES families may be exposed to more high-quality explanations. This may be linked to if and how children from diverse backgrounds use questions that elicit explanations for learning. This is potentially problematic, given that complex explanatory structures are found in the ‘academic language’ (Snow & Uccelli, 2009) used in formal schooling and we have come to expect that by the time ALL children enter formal schooling they prefer to learn from complex explanations — potentially making it difficult for children to negotiate the classroom setting and to interact appropriately with teachers when this is not their preference.

To date, few studies have examined this question-explanation pattern of interaction and its relationship to children’s learning from others. The goal of this dissertation is to investigate how preschoolers use their questions and critical evaluations of explanations from social others to learn about the world (See Figure 1.1).
acquisition begins with the child’s question. Informants’ explanations either aid in this acquisition or hinder it. Depending on the response children receive, they may ask a follow up question or re-ask their original question if they are using their questions to acquire new knowledge.

Through secondary data analyses and experimental methods in both preschool and museum settings, I explore children’s use of questions and epistemic cues (caregiver’s epistemological stance) when (1) learning from adult explanations, and when (2) interacting with a caregiver in an informal learning situation. I include key variables that may influence these social relationships, such as the child’s socioeconomic status (SES) and caregivers’ epistemological stances. This dissertation suggests that the patterns of interaction used for learning that are often privileged in formal schooling may not be synonymous with the patterns of interaction used by children from diverse backgrounds in their early learning experiences with caregivers. These findings have important implications for classroom teachers and how they teach diverse students.

This dissertation is guided by three broad questions:

1) **Are there differences in the types of explanations children hear in response to the questions they ask and their use of follow-up to acquire quality explanations based on SES? (Study 1, Chapter 2)**
Despite the integral role formal schooling plays in children’s acquisition of knowledge, preschoolers spend the majority of their time with caregivers (including grandparents, aunts and uncles) and not in classroom settings that emphasize learning. This is especially true for children from low SES backgrounds (Graden, 1982; Johnson, 2005; Porter et al. 2010). Thus, the primary source for acquiring information that cannot be learned through first hand experiences is often the caregiver.

Few studies have examined the question/explanation/follow-up pattern of interaction between children and their caregivers. Indeed, if this pattern of interaction is used for learning, it is likely that children will persist in question-asking if they receive an inadequate response. Some support for this hypothesis comes from Frazier, Gelman & Wellman (2009), who examined question-asking patterns between children and their caregivers, finding that when children do not receive an explanation in response to an explanatory question, they persist and ask follow up questions.

Despite these results, it is unclear if the conversational strategy of using questions, evaluations of explanations and follow-up to learn about the world is universal. The Frazier et al. (2009) study examined children from white middle-class families, yet patterns of talk differ across ethnic and socioeconomic groups (e.g., Heath, 1983; Hoff, 2006). Children from diverse socioeconomic groups may have different strategies for acquiring new knowledge that do not include question asking, evaluations of explanations.
and follow-up. The study presented here aims to explore differences in responses offered by caregivers to children’s information-seeking questions and children’s reactions to these responses from economically diverse backgrounds.

2) Do children use explanations to make judgments about an informant’s future credibility? (Studies, 2, 3 & 4, Chapter 3) The results from Study 1 should elucidate the pattern of interaction amongst children and caregivers in a naturalistic setting. In Chapter 3, across 3 Studies, I use experimental methods to explore children’s evaluation of an adult’s explanation, and the extent to which they view that adult as a credible source for future learning (selective trust). In Chapter 3, I use the selective trust paradigm (e.g., Corriveau & Harris 2009a; Harris, 2012; Koenig, 2012; Koenig & Woodward, 2010) to explore children’s use of explanation quality to evaluate an informant’s credibility across diverse backgrounds (low-SES vs. mid-SES). I focus on one potential cue that children use when evaluating explanations: argument circularity. I focus on argument circularity as a marker of explanatory coherence. Circular explanations refer to statements that reiterate the information from the original question without adding new information. By contrast, non-circular explanations provide more information than was provided in the original question. I elaborate more on why I focus on argument circularity in Chapter 3. The
findings from this study highlight differences in how children use explanation quality to make inferences about an informant’s (e.g., teacher, caregiver) future credibility.

3) How do children use questions and informant explanations for learning conceptual knowledge?

(Study 5, Chapter 4) The studies related to questions 1 and 2 explain individual differences in questions and explanations, and children’s use of those explanations to make inferences about an informant’s credibility. In Study 5, I explore whether children actually learn from the explanations they hear. Here I examine caregivers’ explanations and children’s use of follow-up questions to acquire conceptual knowledge.

Given that the previous two studies demonstrate that the question, explanation, follow-up pattern of interaction for learning might not be privileged by all children, here I focus on the one group in which this pattern of interaction is clearly privileged: mid- and high- SES families. Additionally, I am interested in the variability of this interaction pattern within this group and potential factors that might cause this variability, namely epistemological stance. The rationale for exploring epistemological stance is explained in more detail in Chapter 4. These findings are important for highlighting the potential that this interaction pattern might have for acquiring conceptual knowledge.

In order to situate the aims and the possible contributions of the present set of studies, the following sections provide an overview of the literature. I begin by exploring the broad context of children’s learning from others before turning to children’s
questions, adult explanations and two factors that potentially moderate adult explanations: socioeconomic background and epistemological stance.

**Context**

**Children’s learning from others**

Is it the case that children blindly trust information provided by others, or, are they selective in whom they turn to in learning situations? This has been a question of interest to developmental psychologists over the past few decades (for reviews see Harris, 2012; Sobel & Kushnir, 2013; Gelman, 2009). This research shows that by age 3, children are surprisingly selective in who they judge to be a trustworthy source.

To determine the cues children use when learning from others, researchers have employed a novel paradigm called the *selective trust paradigm*. The paradigm consists of two phases: a familiarization phase and a test phase. During the familiarization phase, children are presented with information about the differential knowledge of two informants. In the subsequent test phase, children are introduced to an unfamiliar object or situation and given an opportunity to seek and accept information about it from one of the two informants. The extent to which children choose to selectively rely on one of the two informants is measured. Using this paradigm, researchers have found that even preschoolers rely on two broad heuristics (epistemic and social) — acting like little statisticians and little social psychologists (e.g., Corriveau & Harris, 2009a, 2009b; Corriveau, Fusaro & Harris, 2009; Corriveau, Kinzler & Harris, 2013; Harris, 2012; Kinzler, Corriveau & Harris, 2011; Koenig & Woodward, 2010; Mascaro & Sperber, 2009).
**Children’s use of epistemic cues.** One broad heuristic children use when deciding from whom to learn is an informant’s previous accuracy in a particular domain. To determine an informant’s accuracy, children weigh what an informant says against their own past experiences with a given topic. If the informant’s statement is consistent with the child’s past experience (e.g., labeling a ball as a ball), the child can mark this informant as ‘accurate’ and are likely to choose to learn from this informant in future learning scenarios. In contrast, if the informant’s statement is not consistent with the child’s previous experiences (e.g., labeling a ball as a shoe), then the child can mark the informant as ‘inaccurate’ and are likely to avoid learning future information provided by the informant.

In early selective learning studies, 3- and 4-year-old children were asked to judge two different informants – one who was accurate, and one who was inaccurate (Clément, Koenig & Harris, 2004; Koenig, Clément & Harris, 2004; Koenig & Harris, 2005). In the familiarization phase, both informants labeled familiar objects with familiar labels. One informant provided consistently accurate labels (e.g., labeling a ball as a ball), while the other informant provided consistently inaccurate labels (e.g., labeling a ball as a shoe), thus demonstrating consistently accurate or inaccurate behavior. Then, in the test phase, the informants labeled novel objects with conflicting novel labels. Overall both 3- and 4-year-olds prove to be remarkably good at monitoring, predicting and using accuracy when making future judgments about an informant’s future credibility. This information is long-lasting – preschoolers preferred to learn from that informant up to one week after the initial accuracy information (Corriveau & Harris, 2009a).
Taken together, these results indicate that at relatively young ages, children evaluate what they hear to make judgments about an individual’s future credibility. This becomes important when considering how young children, especially during the preschool and early elementary years, evaluate their teachers. Indeed, young children frequently turn to their teachers, who they expect to be experts across multiple knowledge domains, when learning new information. This is potentially problematic given that educators note feeling less prepared in some knowledge domains than others (Brown, Westenskow & Moyer-Packenham, 2011). If educators indicate that they are less knowledgeable in a domain, either through verbal or non-verbal cues, children might attend to those cues and be less likely to consider the teacher a reliable source (and be less likely to acquire the to-be-taught information).

**Weighting multiple cues.** Although a specific focus on children’s relative weighting of social cues is beyond the scope of this dissertation, there are many social cues children weigh simultaneously with epistemic cues, when deciding from whom to learn. Indeed, in a classroom setting, children often have a rich history with their teacher, which may impact their evaluations of the teacher’s credibility. It is likely that children are simultaneously weighing their social history with their teacher with other epistemic cues such as the teacher’s history of being accurate. Several studies have examined how children navigate two competing strategies and found that children’s relative weighting of social and epistemic information changes with development. Three-year-old children weight social information more heavily than accuracy. For example, they are willing to turn to a familiar teacher, regardless of accuracy.
(Corriveau & Harris, 2009b). By contrast, by age 4, accuracy trumps social cues: children selectively prefer to learn from an informant who had previously provided accurate information irrespective of social-group membership (Corriveau, Kinzler & Harris, 2013; Corriveau & Harris, 2009b; see Reyes-Jacquez & Echols, 2013). Taken together, these results suggest that at early ages a child’s social history with an informant might act as a buffer when deciding from whom to learn, however as children develop, children likely rely more on epistemic cues when weighing them against social cues.

In summary, the work to date on children’s selective learning from informants indicates that children attend to many different epistemic cues, and despite their social history with an informant, as children develop they selectively learn from adults who have a history of accuracy. Although these findings provide an important first step for understanding how children learn from others, to date, most of this work has focused on children’s acquisition of relatively simple information—a novel object’s name or function (e.g. Birch, Vauthier & Bloom, 2008; Koenig & Harris, 2005). In the next section, I turn to the questions children ask to acquire the explanations they use when learning from others.

**Children’s questions**

It is well-established that young children ask a lot of questions. Some of these questions are used to gain attention or to ask for permission (e.g., ‘Can you open my sippy cup?’; Callanan & Oakes, 1992; Chouinard, 2007; Greif, Kemler-Nelson, Keil & Gutierrez, 2006), whereas others are used for the purpose of advancing understanding and
knowledge (e.g., ‘Why is the sky blue?’) (Chouinard, 2007; Kemler-Nelson, Egan & Holt, 2004); the latter types of questions often require more sophisticated responses. Initially, it was hypothesized that children use questions as a means of working through their mental schemas to construct their own knowledge and not as a means for acquiring information from a different source (Piaget, 1929). However, current research suggests that children do in fact actively use questions to acquire new knowledge. When children use questions for the purpose of acquiring new knowledge and are not satisfied with the response they receive, they often repeat their question (Kemler-Nelson et al., 2004) or provide their own explanation (Frazier, Gelman, & Wellman, 2009), further suggesting that children use questions as a tool for learning from others and not simply to gain attention. Children often use the knowledge gained from their questions to override core principles, which leads to conceptual change — and the acquisition of conceptual knowledge (Carey & Spelke, 1994). Note, that although all children ask questions (Chouinard, 2007), there is significant variability in the amount and types of questions children ask. Factors such as children’s prior knowledge, encouragement from caregivers, and motivation have been linked to differences in children’s question-asking behaviors (Newman, 1990; Ryan & Pintrich, 1997). Indeed, recent research shows that children are most apt to seek out information about concepts they are learning about. For instance, around the time children make advances in false-belief tasks, children begin asking questions about theory of mind and other mental state phenomena (Chouinard & Imberi-Olivares, 2012).
Questions as a tool for learning. As previously mentioned, many concepts cannot be learned through first-hand observations (e.g., ‘why is the sky blue’). In these instances, because children are unable to check second-hand information against their real-world experience, the new information must be provided by a knowledgeable informant. However, because adults do not always spontaneously provide the information children want, children must ask questions.

Using questions to learn from others involves a surprisingly complex set of cognitive processes (Landrum, Mills & Johnston, 2013; Mills, Legare, Grant & Landrum, 2011; Mills & Landrum, 2014). First, children must be able to recognize when they do not have the knowledge they need to solve a problem or answer a question. Somewhat surprisingly, research indicates that although children use questions as early as age 2 to acquire new information (Chouinard, 2007), they do not always recognize when they need to ask a question. For example, studies have found that when given the choice between answering questions themselves or seeking information from an informant about the contents of a box, 4- and 5-year-olds do not systematically seek out information from another source (even though they recognize which informant should know the information; Robinson, Butterfill, & Nurmsoo, 2011). In a similar study, Aguiar, Stoess, & Taylor (2012) presented 4- 5- and 6-year-olds with 3 experts (a doctor, a firefighter and a farmer). Children were then presented with a set of questions and asked to select the expert (informant) they would assign each question to (e.g., ‘What color is a fire truck?’). All children successfully assigned the majority of questions to the appropriate informant, demonstrating their ability to categorize the domain of questions and to match
them to the corresponding experts. Despite this recognition, in a follow-up study, only 6-year-olds were able to recognize when they did not know the answers to questions themselves and appropriately assigned them to an expert. In contrast, 4- and 5-year-olds were far more likely to overestimate their own knowledge and attempt to answer questions on their own (Aguiar et al., 2012). The ability to recognize when to ask questions is an important first step in the question asking process. These results should not be taken to mean that children under the age of 6 do not use questions effectively. In fact, these results should prompt researchers to ask how and when children younger than 6 use questions and what accounts for the variability in their use of questions (e.g., attributes of the caregiver, inherent traits of the child like curiosity and their prior knowledge of a topic). I address several of these questions in Studies 1 and 5 of this dissertation (Chapters 2 and 4).

Once children have recognized the need to ask questions, they must decide whom to ask. Somewhat surprisingly, recent studies indicate that children are no less likely to direct questions to strangers than they are to their parents (Chouinard & Imberi-Olivares, 2012). This contradicts previous evidence (Tizard & Hughes, 1984), which suggested that children are less likely to ask questions of teachers than of parents. However, it should be noted that the data used to support these findings was collected in very different circumstances, with parents and children engaging in one-on-one conversations while children participating in large group discussions with their teachers. Children likely did not ask as many questions in this setting because they did not have the joint-attention of their teacher, therefore these results should be interpreted with caution. Although children
seemingly ask questions to a range of interlocutors, an open question remains from these two studies: Do children direct their questions to anyone who can or will listen? Or, are they selective in whom they direct their questions to?

Deciding whom to ask requires children to evaluate the credibility and expertise of informants. In everyday life, it is not always clear what information people know, making it difficult for children to decide whom to direct their questions to. Indeed, it is unlikely that children will be faced with the blatant inaccuracies like those used in studies to determine the cues children rely on when learning from others (e.g., Corriveau & Harris, 2009a, 2009b; Corriveau, Kinzler & Harris, 2013). Instead they will most likely use cues of expertise (Aguiar et al., 2012; Mills, Legare, Bills & Mejias, 2010; Landrum, Mills, & Johnston, 2013) and the explanations they hear in response to their questions to judge an informant’s credibility. To date, no study has systematically explored how children monitor explanations and use them to make judgments about an informant’s credibility. It is important to understand how children monitor explanations, as it is often the response they receive when they ask questions. Thus, in the third chapter of this dissertation (Studies 2, 3 & 4), I explore how children monitor explanations to make judgments about an informant’s credibility and how this might vary as a function of individual differences, namely socioeconomic status (SES).

After children have determined who to ask, they must decide what to ask. Indeed, knowing what to ask is often determined by a child’s previous experience with a given topic. For example, if a child is presented with a novel toy, they may need time to explore the toy before being able to formulate appropriate questions about its function. Indeed,
there is likely a great deal of variability in children’s prior knowledge and the opportunity for exploration (Hart & Risley, 1995), which likely informs the types of questions children ask. The types of questions children ask in turn contributes to the types and quality of explanations children receive. Indeed, it is likely that children will receive more elaborate explanations when they ask elaborate questions.

It is evident that children ask many different types of questions (e.g., how, why, what, can, when, where etc.). In some cases, children use their questions to gain attention or to maintain a simple social interaction (Mills & Landrum, 2014), while in most cases they use questions to acquire more information about a particular topic (Hickling & Wellman, 2001). In developmental research, ‘why’ questions are denoted as the quintessential information-seeking question, which are widespread and often used during the preschool years (Callanan & Oakes, 1992; Hickling & Wellman, 2001; Wellman, Hickling & Schult, 1997). Preschoolers know how to use ‘why’ questions to acquire new information (Kemler-Nelson & O’Neil, 2005; Chouinard, 2007; Greif et al. 2006). Indeed, Greif et al. (2006) examined preschoolers’ use of questions to acquire conceptual knowledge about novel artifacts and animals. Researchers presented children with a series of pictures of novel artifacts and novel animals designed to elicit questions (e.g. Tarsier, eats insects; crullet, makes play dough). Children’s questions were recorded and coded. Although children asked general questions such as “What is it?” about artifacts and animals alike, they were more likely to ask about the functions of artifacts, and about category membership, food choices, and habitats of animals. Interestingly, preschoolers never asked questions about either the artifacts or animals that would be considered
inappropriate by adults (e.g., ‘how does a dog live’), suggesting that children realize that in order to understand different entities they must gather different types of information that is acquired through the questions they ask.

Despite knowing who to ask and what information to ask for, it is not always the case that children receive the information they are looking for. There is evidence to suggest that when children use questions for learning, they will likely persist and ask follow-up questions when they receive an inadequate response. In a recent study Frazier, Gelman & Wellman (2009) examined patterns of interactions between children and their caregivers around children’s questions. According to Frazier et al. (2009), this pattern of interaction encompasses three steps (a) the child’s initial question (b) the response the child received and (c) the child’s reaction to this response. When looking at naturalistic interactions between caregivers and their children, Frazier et al. (2009) found that when children do not receive an explanation in response to an explanatory question, they persist and ask follow up questions or they re-ask their original question. In a follow-up experimental study (Frazier et al., 2009), children were presented with situations designed to elicit questions (e.g., nest with a turtle in it). Children either received an explanatory response or a non-explanatory response. Similar to the findings in Study 1, children persisted and re-asked their original question when they received a non-explanatory response.

These results can be taken to mean that children actively use questions as a tool for learning and are able to distinguish between an adequate response and an inadequate response. Despite these results, it is unclear if the strategy of using questions to learn
about the world is universal. Indeed, the children used in this study were predominantly from white middle-class families. Previous research reveals that patterns of talk differ across racial and socioeconomic groups (e.g., Heath, 1983; Hoff, 2006). Therefore, children from diverse racial and socioeconomic groups may have different strategies for acquiring new knowledge that do not include question asking. One possible reason for this difference is the family values embraced by the caregiver that may influence their interactions with their children. Research supports this claim and it has been found that caregiver-child interactions are influenced by the family values embraced by the caregiver (e.g., imagination, education, religion etc.), as well as the caregiver’s access to resources. For example, caregivers who embrace imagination might engage in more pretend play (de Rosnay & Hughes, 2006), whereas those who emphasize religion might spend time with their children participating in religious services (Evans, 2001). Research focused on recent immigrants found that a student’s achievement was related to the emphasis on education shared by the student, their parents, and their peers (Fulingi, 1997). I further explore other potential causes for differences in patterns in caregiver-child interactions later in this review. Before turning to this discussion, I will focus on the responses children receive to the questions that they ask.

Taken together, the aforementioned studies provide evidence that young children not only ask questions, but are also capable of asking appropriately situated questions across a variety of domains. This early emerging and sophisticated skill is a potentially powerful tool for acquiring new knowledge when learning from others. Indeed, it is through these questions that children gain the information that is often used to evaluate an
informant’s credibility. Despite this fact, children’s questions may not always function as the powerful tool that they have the potential to be. In large part, this is due to the responses they receive from adults and other interlocutors. Below I discuss adult explanations and the implications for learning from others.

**Explanations**

To begin to understand how children use explanations when learning from others I must first describe what is meant by explanations. Researchers have posited an array of criteria to define explanations. For instance, Barbieri, Colavita, and Scheuer (1990) write that "an explanation is offered to a partner to clarify something which might be obscure or ambiguous" (p. 246). They include "what" explanations (i.e., the meanings of words, naming of objects), "why" explanations (i.e., causal and purposive expressions), and "how" explanations (i.e., descriptions of processes), whether or not they are explicitly marked. In contrast, Donaldson and Elliot (1990) define explanations as “something that extends our understandings of the world, by moving beyond simple observation of events to the causal links underpinning them” (p. 26), whereas Draper (1988) suggests that “….in everyday life, almost anything may, in the right circumstances, count as an explanation (p. 16). Because I am interested in how explanations are used for learning from others, I adopt Barbieri et al.’s (1990) classification of explanations in the studies presented here.

In the current set of studies, I am interested in questions that require explanations that extend beyond simple responses. As they develop and begin to generate theories about the world, children require more complex explanations (usually in response to their
‘why’ and ‘how’ questions; Chouinard, 2007; Frazier, Gelman & Wellman, 2009; Isaacs, 1930). These explanations are often used by children to understand phenomena that cannot be learned through first-hand experience. Callanan and Oakes (1992) and Chouinard (2007), both investigated explanations caregivers’ offered in response to their children’s questions. Using a diary method, Callanan and Oakes (1992) asked parents to record their children’s questions about “how things work” and “why things happen” and the subsequent explanations provided by the parent. Findings revealed, that when asked a causal question, the majority of parents responded with causal explanations. More often than not, these explanations focused on prior causal factors (e.g., previous events that led to a specific phenomenon) on causal consequences (e.g., events that occurred due to a specific phenomenon). Although these findings provide compelling evidence to suggest that children’s questions are often met with appropriate responses (e.g., causal questions receive an explanatory response), they should be interpreted with caution given that parents were asked to self-report and it is likely that parents are less apt to report providing low-quality explanations than high-quality explanations.

To date, research has linked the complexity and quality of explanations that adults offer to a variety of factors including the gender of the child; finding that parents typically offer more explanations to boys when learning about science than to girls (Crowley, Callanan, Tenenbaum, & Allen, 2001) and parental education level; finding that parents with higher levels of education offer more causal explanations than parents with basic levels of education (Tenenbaum & Callanan, 2008). Although no studies to date have explicitly explored how differences in these interactions are linked to learning
outcomes, researchers have argued that these interactions potentially influence later
science learning (e.g., Siegel, Esterly & Callanan, 2007; Tenenbaum, Snow, Roach &
Kurland, 2005). Therefore, it is important to consider how children use explanations
when learning from others. In Studies 2, 3 & 4 of this dissertation I explore how children
use explanations when learning from others (Chapter 3).

**Learning from Explanations.** To evaluate a speaker’s credibility, not only do
children rely on social cues (e.g., race, accent etc.), but it is likely they evaluate the
quality of the speaker’s explanation itself. The task of evaluating explanations to
determine informant credibility is more complex than evaluating single-word utterances.
Not only do children need to compare the speaker’s utterance to their own background
knowledge to determine any inaccuracies, which varies greatly depending on children’s
experiences, they also need to evaluate the internal coherence of the statement to ensure
that there are no inconsistencies. These tasks are difficult even for adults and older
children. Indeed, adults are often influenced by social factors such as confidence,
attractiveness, or assertiveness (Todorov, Gobbini, Evans & Haxby, 2007; Todorov &
Uleman, 2003), ignoring blatant inconsistencies within an informant’s explanation.

Very little research has systematically explored children’s ability to evaluate
arguments and explanations. In one study, Markman (1979) presented 8- and 11-year-
olds with a passage that had an inconsistency in it. An example of such a passage might
be, “Fish need light in order to see. There is absolutely no light at the bottom of the
ocean…Some fish that live at the bottom of the ocean can see the color of their food.”
Only the 11-year-olds noticed the inconsistency – and even they required probes before

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they would mention it. Similarly, Baum, Danovitch & Keil (2008) presented 5- to 10-year-olds with two types of explanations: a circular explanation, and a noncircular explanation. Circular explanations were those that reiterated the question that was asked (e.g., polar bears have white fur because their fur is white, not black or another color) while non-circular explanations were those that provided more information (e.g., a polar bear has white fur because they live in snowy places. Since the snow is white, it’s hard for the bears’ enemies to find it and hurt it). Whereas 5-year-olds had only a fragile preference for the noncircular explanation, 10-year-olds displayed a robust preference for the noncircular explanations. An open question from both of these studies is how children evaluate the explanations provided by particular informants. For example, even if young children had difficulty explicitly expressing a preference for the noncircular explanation, it is plausible that they might evaluate the source of the noncircular explanation as more credible. Specifically, would they prefer to learn future information from the source using better arguments and explanations? I explore this question in Chapter 3 of this dissertation.

Some recent evidence supports the possibility that young children attend to a speaker’s explanatory sentence structure when deciding whom to selectively learn from (Bernard, Mercier & Clément, 2012). Specifically, 3- year-olds, 5-year-olds and adults were presented with two speakers who provided explanations for the location of a hidden object. One speaker used a causal connective (i.e. “The ball is in the green box because Camille always puts her ball in the green box.”) whereas the other speaker used a phatic term (i.e., “The ball is in the blue box, well, Camille always puts her ball in the blue
Four- and 5-year-olds selectively preferred to search in the location identified by the speaker using causal connectives. Moreover, Mercier, Bernard and Clément (2014) demonstrated that children’s ability to monitor the quality of explanations develops over the preschool years.

Despite the compelling evidence that children do monitor explanation quality, studies to date that look at explanation quality have been relatively controlled. If exposure to high-quality explanations does have an impact on children’s learning and how they perceive informants, then it is important to consider the factors that influence the quality of the explanations children might hear.

**Moderating Factors that influence parent-child interactions**

Children’s first learning partners are often their caregivers. From the early strategy of using imitation to learn (e.g., Meltzoff, 1999; Stewart & Hamilton, 1976) to later asking questions and using adult explanations/responses to learn (e.g., Callanan & Oakes, 1992; Chouinard, 2007) there are many different factors that influence these interaction patterns. In the current dissertation, I am interested in (1) demographic background: socioeconomic status (SES) and race, and (2) the caregiver’s epistemological stance (Kuhn, 2001). I focus on these two variables because previous work indicates that children from mid-SES families prefer explanations with greater syntactic complexity than children from low-SES families (Corriveau & Kurkul, in prep.). By implication, children from low-SES families may be exposed to less syntactically complex explanations. Moreover, recent work indicates that children’s evidence-based talk is based on the epistemological stance of their mother (Luce,
Thus, it is plausible that both informant-level variables may influence children’s learning from explanations. Below, I provide a more systematic review of the possible influence of SES and epistemological stance for children’s learning from explanations.

**Socioeconomic Status (SES).** Socioeconomic status (SES) is a powerful variable that is often considered in developmental research. Many aspects of child development have been linked to SES. Indeed, a large body of work has documented individual differences in children’s linguistic environment as a function of the mother’s socioeconomic status (SES) and education level (Hart & Risley, 1995; Hoff & Tian 2005; Tizard & Hughes, 1984; Snow, 1991). Lower SES mothers have consistently been found to talk less, to use a smaller vocabulary, to be more directive, to use prohibitory language (e.g., ‘shut up,’ ‘be quiet,’ ‘not now’) and to ask fewer questions of their children than higher SES mothers (Hoff, Laursen, & Tardif, 2002). In turn, children from lower SES families have been found to have discrepancies in language development (Bornstein, Haynes, & Painter, 1998; Hart & Risley, 1995; Hoff & Naigles, 2002; Huttenlocher, Haight, Bryk, Seltzer, & Lyons, 1991; Weizman & Snow, 2001). For example, individual differences in early exposure to complex language are related to differences in the complexity of children’s language production (Huttenlocher et al., 2002; Huttenlocher, Vasilyeva, & Shimpi, 2004), as well as differences in syntactic comprehension and verbal growth by the child (Huttenlocher et al., 2002). These differences in language development may influence the quality of the question/explanation pattern of interaction and how children use questions and evaluate the explanations they receive when learning
When considering these differences it is important to consider the environmental factors that may cause them. For example, mid/high-SES children have greater exposure to books and literacy activities (Payne, Whitehurst & Angell, 1994; Scarborough & Dobrich, 1994) that may result in exposure to more vocabulary and more complex explanations. Thus, mid-SES patterns of parent talk may include more explanations by nature, making mid-SES children more likely to use questions and evaluations of explanations as a tool for acquiring new knowledge. In Study 1 (Chapter 2), I look at individual differences in the questions children ask, the explanations they receive and their reactions to explanations.

**Epistemic Stance.** I anticipate differences in how children across diverse backgrounds use questions and explanations when learning from others. Given the previous literature (e.g., Corriveau & Kurkul, in prep; Hart & Risley, 1995), I expect that children from low-SES backgrounds will be less likely to use question asking and the explanations they hear as a default mechanism for learning from others. Therefore, in Study 5 (Chapter 4), I will begin by exploring what children learn from the explanations they hear in mid/high-SES children and a moderating variable that may contribute to within group differences.

The second moderating variable I consider in this dissertation is individual differences in learning from explanations based on caregivers’ epistemic stances. Broadly speaking, epistemological stance refers to one’s own beliefs about the nature of knowing (Bang & Medin, 2010; King & Kitchener, 2004; Kuhn, Cheney, & Weinstock, 2000;
Sandoval, 2005). Research indicates that when deciding who to learn from, children attend to *epistemic characteristics*; features that relate to the quality of what the informant is saying (e.g., accuracy; Birch, Vauthier & Bloom, 2008; Clément, Koenig & Harris, 2004; Corriveau, Meints & Harris, 2009; Corriveau, Pickard & Harris, 2011; Koenig & Harris, 2005; Koenig & Woodward, 2010; Sabbagh & Baldwin, 2001; Scofield & Behrend, 2007). As previously noted, the majority of these studies have explored children’s single-word learning from blatantly inaccurate or accurate informants. Needless to say, it is difficult to extend these findings to children’s everyday learning, where they are more likely to be faced longer with longer utterances that are less blatantly inaccurate. Surprisingly, few studies have focused on the patterns of information that children will likely encounter in everyday interactions (Callanan & Valle, 2008; Gelman, 2009). These patterns are likely altered by some characteristic of the interlocutor’s own beliefs about how knowledge is constructed (their epistemic stance).

Epistemological stances have been divided into several categories (Kuhn, 2001). An *absolutist* stance, according to Kuhn, is one that makes assertions that are seen as right or wrong, and is perceived as fixed truth (Kuhn, 2001). For example, seeing science as merely a set of facts or statements such as “Girls are just born sweeter than boys” might imply an absolutist stance. In contrast, a *multiplist* stance assumes that knowledge comes from humans, beliefs are uncertain, and reasoning can be relativistic. Indeed, a person who adopts a *multiplist* stance will likely not use evidence to support one side of an argument, but rather; perceive both sides of an argument to have some truth. For
example, when talking about social issues (e.g. prayer in school, school start-time etc.), *multiplists* will present both sides of the issue and likely find truth in both. Finally, an *evaluativist* stance recognizes knowledge as originating from humans and therefore as uncertain, but it posits that beliefs are constructed based on evidence and that judgments are made by testing hypotheses or finding disconfirming evidence (e.g., learning about gravity by dropping a ball). Arguably, these stances influence the way adults construct knowledge, which alters the responses they provide to their children in learning scenarios where children use questions to acquire knowledge. That is, if an individual perceives knowledge as a set of facts and constructs their understanding of the world by viewing facts as absolute truth, then he will likely use facts when responding to his child’s questions.

Although no studies to date have looked at the direct effects of epistemological stance on adult’s responses to children’s questions and its impact on children’s learning; several studies have examined how caregivers’ epistemological stances relate to children’s reasoning and children’s evidence talk. For example, Valle (2009) presented 8 and 11-year-olds and their parents with a series of conflicting scenarios (e.g., Did the Egyptians build the pyramids?). Each scenario consisted of two different claims (e.g., ‘Most historians claim that Egyptians built the pyramids as tombs for their kings’; ‘Other historians claim that most Egyptians did not have the mathematical experience to build the pyramids’). Parents and children were asked a series of questions to elicit their opinions about the topic. Parent-child conversations were recorded and coded for the use of evidence to support the claims. Researchers were interested in to what extent
caregivers voluntarily used evidence to support their reasoning. In an additional task, children and caregivers were presented with the opportunity to identify a hypothesis for a given problem and identify a way to test the hypothesis. The reasoning strategies used by the parent to deduce a hypothesis were coded. In addition to these tasks, parents were given two questionnaires to measure their epistemological stances (Value of Scientific Reasoning Scale and Ideas about Science questionnaire). Results indicated that 98% of highly-educated parents encouraged the use of evidence to support conclusions (Valle, 2009). In addition, the use of evidence was connected to epistemological beliefs, in that parents who subscribed to a non-absolutist stance, were more likely to use evidence to support their claims. Although Valle (2009) did not look directly at how caregiver’s evidence talk and epistemic stances were related to children’s reasoning, these findings provide important insight for how children’s conversations with their caregivers might contribute to children’s development of reasoning strategies. These findings have important implications for learning because regular participation in discussions in which critical thinking and the use of evidence to support ideas are encouraged may relate to development of formal deductive reasoning in children (Chappell & Overton, 1998).

In a subsequent study, Luce, Callanan & Smilovic (2013), looked at the link between parent’s epistemological stance and preschoolers’ evidence talk. Similar to Valle (2009), Luce et al. (2013), presented children and their caregivers with a book that contained several science-related topics that would likely come up in everyday conversation (e.g., global warming, Pluto no longer being a planet). Each page of the book consisted of a question that related to epistemic stance (e.g., a page on global
warming, briefly describing multiple perspectives about global warming and then asking the question “How could someone figure out why the earth is getting warmer?”). Responses to these questions were recorded and coded for the epistemological stance they exhibited (e.g., absolutist, multiplist, evaluativist). Utterances were coded as absolutist if a parent provided evidence “only for their own position, if one side of the argument was dismissed or easily explained away, or if only one side was explicitly described as correct” (Luce et al., p. 456). An utterance received a multiplist code if parents “described both sides of an argument as equally correct, declined to discuss the topic by saying there is no way to tell the answer, or stated that the situation is too complex or uncertain to know” (Luce et al., p. 456). Finally, an evaluativist code was assigned when a parent “actively integrated evidence from multiple experts/sources to reach an answer, suggested a way to collect evidence to help decide, or focused on the complexity of the issue while valuing evidence as part of the evaluation” (Luce et al., p. 456). In addition to coding parent-talk, Luce et al. (2013) coded children’s evidence talk in their discussions about angels, germs and mammoths. Both children’s use of evidence and their questions looking for evidence were coded. Results indicated that parents’ expressions of absolutist and evaluativist stances to their children varied depending on the topic under discussion, with more evaluativist talk apparent in science related discussions (e.g., what makes Pluto a planet) than in value-based discussions (e.g., whether it is okay to steal). Indeed, parents’ science backgrounds, as well as the age of the child influenced the stances exhibited by parents, with parents of younger children (4-to 6-year-olds) exhibiting an absolutist stance more frequently (Luce et al., 2013). When
looking at the children’s evidence talk and its link to epistemic stance, findings indicated that children’s ability to use evidence and to ask questions related to evidence were significantly related to parents’ expressions of an evaluativist stance.

Taken together, the emerging literature on the effects of epistemic stance in adult-child interactions suggests that one’s epistemological stance does influence caregivers’ interactions with their children. Of interest is whether differences in epistemological stances also influence children’s decisions about the credibility of their learning partner. Thus, an open question from these studies remains: does one type of epistemological stance lead to differences in the types of answers children seek to their questions and in turn differences in their ability to acquire conceptual knowledge? In Study 5 (Chapter 4), I compare the effects of an absolutist stance to the effects of an evaluativist stance on the explanations caregiver’s provide in response to their children’s questions to aid in the process of learning conceptual knowledge. I focus on the evaluativist and absolutist stance because the content children will be learning falls in the science domain and previous work suggests that two types of epistemic stances are employed when talking about science: the evaluativist stance and the absolutist stance.

This dissertation suggests that there might be differences in how children use their questions and explanations to learn from others. This is potentially problematic given that the Western school system relies on children to ask questions and use the explanations provided by teachers for learning. Across 2 studies, I highlight individual differences. In Studies 1 through 4, I examine SES based differences. Given that the findings from Studies 1 through 4 (Chapters 2 and 3) demonstrated that children from mid/high SES
most readily use the question, explanation, follow-up pattern for interaction, I explore if these children learn from the explanations they hear in Study 5 (Chapter 4). In future work I intend to look more closely at interactions between caregivers and children from low SES families during learning scenarios.
Chapter 2: The questions they ask, the explanations they hear and children’s follow-up:

Differences in interaction patterns for learning from others across SES and racial backgrounds

Introduction

Chapter 1 highlighted several studies that looked at two different aspects of an interaction pattern that children might use when learning from others: children’s questions and caregivers responses (explanations). It is clear from the aforementioned studies that question-asking involves a complex set of cognitive processes (e.g., Landrum, Mills & Johnston, 2013; Mills, Legare, Grant & Landrum, 2011; Mills & Landrum, 2014) and at surprisingly young ages children can distinguish between high quality and low quality explanations (e.g., Baum, Danovitch & Keil, 2008; Bernard, Mercier & Clément, 2012). Nevertheless, few studies have explored how children use their questions to search for explanations and how they respond to the information they obtain. Indeed, if children use their questions for learning and receive an unsatisfactory response, they will likely follow-up until they receive the information they desire. In the current study I focus on this entire pattern of interaction as a mechanism for learning from others (see Fig. 2.1).

As previously noted, Frazier, Gelman and Wellman (2009) found that when

(Figure 2.1 Research model. Study 2 explores the entire interaction pattern.)
seeking causal information children are likely to re-ask their original question if they do not receive an explanatory response. Here, they focused only on children’s ‘how’ and ‘why’ questions. Indeed, these are two types of questions that children use for learning, but it is likely children use other types of questions (e.g., ‘what,’ ‘where,’ etc.). Therefore, in the current study I focus on all types of questions used for learning (causal questions and fact-based questions). Moreover, Frazier Gelman and Wellman (2009) only focused on mid-SES white children. This is potentially problematic given that differences in interaction patterns have been found to exist across children from diverse backgrounds and they may not rely on the same conversational strategies when learning from others. An open question remains, are there differences across sociocultural contexts in the conversational strategies children use to learn from others?

During the preschool years children generate many theories about the world (Carey, 1985; Wellman & Gelman, 1998) and ask many questions (Chouinard, 2007; Hickling & Wellman, 2001) that are motivated by an innate human curiosity about the world (Simon, 2001). Children seek to acquire knowledge to better understand their world, often turning to adult informants when the information they desire cannot be learned through first-hand observations or exploration (e.g., ‘what happens to a balloon when it flies into the sky?’). Children seek a diverse range of information when learning about the world, from simple concepts like the names of objects to more complex concepts like causal mechanisms (Callanan, 1990, 1991; Jipson & Callanan 2003; Callanan et al., 1995; Crowley et al., 2001). By the time children are 4-years-old they know what type of questions to ask to obtain the information they desire (Kemler, Nelson
When seeking fact-based information (‘where do bees live?’) children rely on ‘what,’ ‘where,’ and ‘who’ questions. These types of questions are the first to be acquired (Tyak & Ingram, 1977; Cairns & Hsu, 1978; Bloom, Merkin, & Wootten, 1982) while children do not use ‘how,’ ‘why; and ‘when,’ questions until much later. The emergence of questions to acquire facts occurs around 2-years-old, a time in development where children begin to understand that words can be mapped onto objects to give them meaning. At around 2 ½ years, children begin to string together words to make meaning and their understanding of differences among various syntactic constructions emerges (Siegler & Alibali, 2005). Given this developing understanding of the function of language, it makes sense that children begin to use fact-based questions at this age, as they likely use them as a tool to label objects (e.g., ‘What’s that?’). To demonstrate the frequency with which children use fact-based questions, in Study 1 of Chouinard’s (2007) monograph, she examined the transcripts of 4 preschool-aged children from the CHILDES database. Using a tally method, she found that the majority of questions asked by children were information seeking (as opposed to attention-seeking, action-seeking, or permission-seeking). At all ages Chouinard (2007) found that children most frequently asked fact-based questions. However, she did find that children’s use of causal questions increased with age (only 4% of total question at age 2 to 30% at age 5). Interestingly, Chouinard (2007) found that each child demonstrated a significant increase in the proportion of causal questions they asked around age 3, suggesting this may be around the time they begin to actively seek and understand not only fact-based but also causal
When trying to understand causal information (e.g., ‘why does an object sink?’) children are likely to use ‘how’ and ‘why’ questions. Although there is a large body of literature to confirm that children’s understanding of causality emerges around age 3 (Bullock & Gelman, 1979; Shultz & Mendelson, 1975), more recent literature suggests that even infants can make causal inferences (Gopnik & Schulz, 2004; Sobel & Kirkham, 2006). Given these findings, it is somewhat surprising that few studies have considered if and how children seek causal information. Indeed, many of the concepts children learn that cannot be observed through first-hand observations consider cause and effect relationships and causal mechanisms. Thus, to learn this information children seemingly have one of two options a) wait for an interlocutor to spontaneously provide an explanation or b) actively seek the information by posing a causal question. Few studies to date have examined the former, however, studies exploring children’s questions have found that children as young as 3 actively ask causal questions (‘why?’ and ‘how come’) about a variety of phenomena in their everyday lives (Callanan & Oakes, 1992). Using a diary method Callanan & Oakes (1992) asked mothers of 3-, 4- and 5-year-olds to record children’s questions for 2 weeks. Analysis revealed that children asked causal questions for a variety of natural, mechanical and social phenomenon, suggesting that children seek explanations across a variety of domains. These findings were replicated in a high- and low- SES sample of Mexican descent families (Callanan, Perez-Garnados, Barajas, & Goldberg, 1999). No comparisons were made across groups (white mid-SES, Mexican-mid-SES, Mexican-low-SES) in terms of the frequency with which children asked causal
questions. Therefore, it is unclear from these studies if children across diverse racial groups ask causal questions with the same frequency. Indeed, several studies exploring adolescence and adult-learners show significant differences across cultural groups in the frequency with which students ask questions in classroom settings, (e.g., Morris & Frazier, 2013) suggesting that question-asking may not be a default mechanism for learning across all cultures. In the current study I explore how socioeconomic and racial backgrounds contribute to the frequency with which children ask causal and fact-based information seeking questions for learning. I expect that children who ask fact-based and causal information seeking questions more frequently are more likely to use them as a strategy for learning from others.

The responses children receive to the questions they ask are as critical for learning as the questions themselves. Several studies have explored adult responses to children’s questions and found that mothers of 3-year-olds report responding less with causal explanations (32% of the time) than mothers of 5-year-olds (approx. 50% to 60% of the time) (Callanan & Oakes, 1992). Chouinard (2007; Studies 1 and 3) found similar results in her monograph when collapsing across children’s fact-seeking and explanation-seeking questions. When looking at the responses to children’s questions across 4 longitudinal transcripts, caregivers offered an informative reply either immediately following the child’s question or after the child re-asked his original question approximately 64%–79% of the time depending on the child’s age. This result was replicated in an experimental study, where adults offered informative responses 78–86% of the time. Chouinard (2007) argues that the variability in responses due to children’s
age is likely due to parents’ perceptions of their children’s abilities and readiness to learn a new concept. Indeed it has been found that because of children’s special relationship with their parents, parents are particularly sensitive to their children’s knowledge states and are much better at scaffolding learning situations for their children than peers (Cicirelli, 1976; Perez-Granados & Callanan, 1997). Therefore, parents of younger children may be less apt to offer explanations to their children if they do not feel as though their child has the appropriate prior knowledge to make sense of the new knowledge. The current study focuses on caregivers as the source children direct their questions to.

Although the variability in the frequency of explanations parents provide based on their children’s age is well-documented, less is known about variability in explanation quality and potential reasons for this variability. Children are exposed to a range of explanations, some high-quality and some low-quality. An early study from the field of Sociology revealed that social class (SES) was the most predictive index (over caregiver’s IQ and child’s sex) of the quality of responses mothers gave to their children’s questions (Robinson & Rackstraw, 1967). Here, mothers were presented with 6 hypothetical questions (2 ‘where’ questions; 4 ‘why’ questions) and asked how they would respond if their child asked the question. In comparison to the low-SES mothers, mid-SES mothers were more likely to provide more accurate information that was embedded in less ‘noisy linguistic’ contexts than low-SES mothers (Robinson & Rackstraw, 1967). Moreover, when looking at mother’s responses to ‘why’ questions, mid-SES mothers were more likely to use complex explanatory structures, analogies and
were less likely to repeat the question as the answer (circular response). Although these findings provide an important first step for understanding caregiver’s responses to their children’s questions, they are somewhat limited because the questions were hypothetical and asked by an experimenter. Somewhat surprisingly, to my knowledge, no study to date has explored the variability in the types of explanations and quality of responses children receive to the questions they ask in naturalistic settings. In the current study I examine the explanations caregiver’s across racial and socioeconomic groups provide to their children in naturalistic settings. In addition, I look at the quality of the responses children receive. Here I focus on explanation circularity as a marker of explanation quality. Circular explanations refer to statements that reiterate the information from the original question without adding new information. By contrast, non-circular explanations provide more information than was provided in the original question – by definition making them more high quality than circular explanations. Therefore, when considering the implications for children’s learning, it can be argued that non-circular explanations teach new information whereas circular explanations do not expose children to new information for learning.

The aforementioned work clearly indicates that children’s questions are often an effective tool for learning information from adults; providing that adults provide high-quality responses. What is not clear however, is what children do if they do not receive an appropriate response. Arguably, if children are using their questions as a tool for learning, then they would likely persist until they receive a satisfactory response. Thus, the nature of children’s responses (e.g., re-asking their original question, dropping the topic, accepting what the adult says etc.) provides critically important information about
the purpose of the initial question that was asked. For example, if a child is using
questions as a tool to engage an interlocutor, then he will likely be satisfied with any
response. However, if a child is using his questions to learn new knowledge, then he will
likely persist until he receives a satisfactory response. Chouinard (2007) provided an
initial look at this hypothesis by examining cases when children re-asked their original
question. Chouinard (2007) found that cases when children repeated their original
question were more frequent following a non-informative response to a factual question
than informative responses. More recently, Frazier, Gelman and Wellman (2009)
investigated this hypothesis in the context of children’s natural conversations with their
caregivers and in an experimental setting. Frazier et al. (2009) investigated children’s
causal questions across 6 transcripts taken from the CHILDES database (MacWhinney &
Snow, 2000). When looking at the pattern of child responses in relation to the type of
explanation that an adult offered (non-explanatory vs. explanatory), Frazier et al. (2009)
found that children’s responses were determined by whether or not they received an
explanatory response to causal questions. When a non-explanatory response was
received, children were more likely to re-ask their original question or to provide their
own explanation, suggesting that children are not simply trying to extend conversations
with follow-up, but are systematic in their responses. Frazier et al. (2009) replicated these
findings in a follow-up experiment where they presented children with objects,
storybooks, pictures, and short videos. Each item contained an unusual aspect (e.g., a hat
with a hole in the top) that was designed to elicit questions from the child. If the child
asked a causal *why* or *how* question, the researcher responded by providing an
explanatory (e.g., ‘It’s to put a pony tail in’) or non-explanatory response (e.g., ‘Hats don’t usually have holes in them’). Similar to their previous findings, children were more likely to re-ask their original question or provide their own explanation in response to non-explanatory responses than to explanatory responses (Frazier et al., 2009). These findings further suggest that children are systematic in how they react to the responses they receive to the questions they ask, and that they appear to use the question, explanation, follow-up pattern of interaction as a mechanism for learning from others.

Although these findings provide compelling evidence to suggest that children engage in a systematic pattern of interaction when seeking knowledge from others, it is unclear if this pattern is privileged across children from diverse backgrounds. Indeed, there is evidence to suggest that differences may exist in the patterns of interactions between children and caregivers (e.g., Hart & Risley, 1995; Heath, 1983; Hoff, 2006). In particular, if the evidence from Robinson and Rackstraw (1967) extends to naturalistic conversations, I expect that there will be considerable variability in the explanations children from diverse socioeconomic backgrounds are exposed to, potentially altering children’s reactions. That is if a child receives no responses or a limited response to a causal or fact-based information seeking question, they may develop different strategies for reacting to caregivers. Understanding the nature of this pattern of interaction across diverse groups has important implications for classroom practice, where this pattern of interaction is privileged (Schultz, 2009). I discuss the implications of these findings in the discussion section of this chapter and further in chapter 6 of this dissertation.

These issues led me to explore whether or not children from diverse backgrounds
show different question-asking behaviors, receive different quality responses and react differently to caregiver’s responses. Given the compelling evidence to suggest differences in caregiver-child interactions across socioeconomic groups and the early and wide vocabulary gaps by SES (Fernald et al., 2013; Hart & Risley, 1992; Hart & Risely, 1995), I chose to focus specifically on differences in the question, explanation, follow-up pattern of interaction by SES. Specifically, this study was designed to address the following questions:

1.) Are there sociocultural differences in the proportion of causal and fact-based information seeking questions children ask?

2.) Are there sociocultural differences in the proportion of explanations caregivers offer to questions that require explanatory responses?

3.) Are there sociocultural differences in the proportion of high-quality responses children are exposed to?

4.) Are there sociocultural differences in children’s reactions to their caregivers’ responses?

Method

Participants. Thirty-seven transcripts of caregiver-child conversations taken from the Hall (1984) corpus in the CHILDES database (18-mid-SES; 19-low-SES) (MacWhinney, 2000) were used. Socioeconomic status was marked by the professional status of the caregiver. The CHILDES database consists of samples of children’s conversations with parents, siblings, and occasional visitors during everyday activities in the home setting. Forty-three percent of the transcripts came from white families, while the remaining 57%
were from black families. All of the transcripts consisted of everyday conversations between native-English-speaking 4-year-olds and their caregivers. Ninety percent of the caregivers were the children’s mothers, while the remaining 10% were fathers.

**Procedure.** I began by conducting a computerized search for child utterances that included question words (e.g., ‘how’, ‘what’, ‘why’, ‘where’) across all 37 transcripts. I then eliminated utterances that were not initiated by the child, yielding 1,072 child-initiated questions. Child initiated questions were marked as the beginning of a new exchange. An exchange consisted of three components: child’s question, caregiver’s response, and the child’s reaction. In some instances, the exchange continued when the caregiver responded to the child’s reaction. An exchange was marked as complete when a child asked a new question pertaining to a new topic.

*Example of exchange pattern*

CHILD (question): *Why is it wrapped up?* (P# 25, L: 3792)

CAREGIVER (response): *That’s the way it came from Florida. Sometimes when they ship fruit they put it in tissue paper.* (P # 25, L: 3793)

CHILD (reaction): *Oh* (P # 25, L: 3794)

Additionally, all incomplete questions and unintelligible utterances were removed. If the unintelligible utterance was in any other part of the exchange (e.g., caregiver’s response) the entire exchange was removed. Next, a 3-part coding scheme was applied that consisted of (1) the child’s initial question, (2) the caregiver’s response, and (3) the child’s reaction to the caregiver’s response. This pattern of discourse has been documented as an exchange pattern that is used for acquiring new knowledge (e.g.,
Chouinard, 2007; Frazier et al., 2009). When coding the caregiver’s responses and child’s reaction, only the two utterances immediately following the child’s question were coded. All coding was conducted by examining exchanges in the context of the entire transcript. This allowed coders to read as much of the previous conversation as needed to help them situate each utterance in the appropriate context.

*Children’s questions.* The coding scheme used for questions was designed to isolate questions that were potentially useful for acquiring new knowledge (information-seeking), as opposed to questions that were clearly less useful (non-information seeking). Information-seeking questions included two different types of questions: fact-based questions and causal questions. A question was coded as fact-based when a child asked a ‘what,’ ‘when,’ ‘where’ or ‘who’ question (see example below) that was used to acquire knowledge. A question was coded as causal when a child asked a ‘how’ or ‘why’ question (see example below) to acquire knowledge.

Examples: *Information-Seeking Questions*

Fact-based information (what/where/who/when): ‘Are there elephants in the circus?’ (P #1, L: 3652)

Causal (how/why/ how come): ‘How do you talk through this?’ (P #24, L: 173)

Non-information seeking questions included two distinct types: Permission-seeking and action-seeking. Questions were coded as permission-seeking when a child asked a caregiver for approval to complete an action (see example below). Questions were coded as action seeking when a child asked a question (‘can’, ‘want to’) that required the caregiver to respond with an action.
Examples: *Non-Information Seeking Questions*

Permission-seeking (can): ‘Ma, can I go in the hallway and play football?’(P #17, L: 130)

Action-seeking (can/ want to): ‘Can you get my slipper?’(P # 36, L: 5079).

Recall that the purpose of the dissertation is to explore the role of question-explanation interactions as a mechanism for knowledge acquisition. Thus, all additional analyses (caregiver’s response, children’s follow-up) were conducted with respect to responses to information-seeking questions only.

*Caregiver’s responses.* Caregiver’s responses to information-seeking questions were coded across 6 categories. Categories included (a) response on topic, no explanation needed (b) response on topic with explanation (c) response on topic no explanation (d) response unrelated (e) turns the question back (Chouinard, 2007) (f) no response.

Response on topic, no explanation needed was assigned when a child asked an information seeking question (fact-based or causal) that did not need an explanation and the caregiver provided an on-topic response. Because causal questions typically require explanations, this category was removed from analysis when looking specifically at responses to causal questions.

Example: *Response on-topic no explanation needed*

CHILD: ‘What’s in here?’(P #22, L: 278)

CAREGIVER RESPONSE: ‘Coffee’ (P# 22, L: 279)

Response on topic with explanation was applied when a child asked a question and received an explanation (e.g., *how, why*).
Example: *Response on-topic with an explanation*

CHILD: ‘Why do we always take the car on Monday?’ (P # 31, L: 153)

CAREGIVER RESPONSE: ‘Because I have nine o’clock class.’ (P # 31, L: 154)

Response on topic no explanation was assigned when a caregiver gave an appropriate response, however an explanation was not given. This category is different from on-topic-no explanation needed because many causal questions needed explanations, however the caregiver only provided a brief responses without an explanation.

Example: *Response on-topic no explanation*

CHILD: ‘Daddy why are you tearing off the directions?’(P3, L: 3196)

CAREGIVER RESPONSE: ‘Yeah’ (P3, L: 3197)

Response unrelated was assigned when caregivers responded with information that was not related to the question the child asked.

Example: *Response unrelated*

CHILD: ‘What? Did you say it’s a chair?’(P # 24, L: 3556)

CAREGIVER RESPONSE: ‘No, it’s good’ (P # 24, L: 3557)

Turns the question back was assigned when a caregiver attempted to get the child to answer his own question.

Example: *Turns question back*

CHILD: ‘How come you keep coughing?’(P # 22, L: 402)

CAREGIVER RESPONSE: ‘What happens when water goes down your throat the wrong way?’(P # 22, L: 403)
Quality of caregiver responses. The quality of caregiver’s responses were coded as circular or non-circular. After coding caregiver’s responses, researchers selected all cases that included a response on topic with explanation and coded the explanation. An explanation was coded as circular if it repeated the question as an explanation (see example below).

Example: Circular response

CHILD: ‘Why didn’t you like them?’ (P # 24, L: 4995)

CAREGIVER RESPONSE: ‘Because I decided I didn’t like them when I go home’ (P # 24, L: 4997)

Explanations were coded as non-circular if it provided additional information from the question that was asked.

Example: Non-circular response

CHILD: ‘What kind of tickets are these?’ (P: #1, L: 2034)

CAREGIVER RESPONSE: ‘Well when you go to the circus you have to buy tickets, you know, so you can get inside.’ (P # 1, L: 2047)

Child’s reactions. The child’s reactions were initially coded into one of seven categories, including: (a) agrees with caregiver response, (b) asks a follow-up question, (c) re-asks original question, (d) provides own explanation, (e) disagrees with caregiver response, (f) provides additional on-topic details and (g) no response.

Agrees with caregiver response was coded when the caregiver provided a response and the child responded by saying ‘yes/yeah,’ ‘oh,’ or repeated the caregiver’s response.
Example: *Agrees with caregiver response*

CAREGIVER RESPONSE: ‘I don’t want to ask her in front of the others kids, so we will ask her quietly’ (P #25, L: 851)

CHILD REACTION: ‘Okay, quietly’ (P #25, L: 852)

I coded responses as *asks a follow-up question* when the child responded by asking a question that was on the same general topic as the original question, but requested different information than was requested in the original question.

Example: *Asks a follow-up question for elaboration*

CHILD QUESTION: ‘Giving him seeds?’(P # 25, L: 125)

CAREGIVER RESPONSE: ‘Yes, Daddy is feeding him gerbil seeds.’(P # 25, L: 127)

CHILD REACTION: ‘What kind of seeds?’(P # 25, L: 128)

I coded responses as *re-asks the original question* when a child repeated their original question or some variation of the question that request the same information.

Example: *Re-asks original question*

CHILD QUESTION: ‘What’s cooking in there?’(P # 29, L: 2770)

CAREGIVER RESPONSE: ‘Todd, listen, do you want your burger?’ (P # 29, L: 2771)

CHILD REACTION: ‘What’s cooking in there?’(P # 29, L: 2772)

The *provides own explanation* code was assigned when a child offered an alternative explanation to the one the caregiver provided or when the child provided his own explanation when the caregiver had not given one.
Example: *Provides own explanation*

CHILD QUESTION: ‘How come?’ (P # 8, L: 4301)

CAREGIVER RESPONSE: no response (P # 8, no line)

CHILD REACTION: ‘It’s because he didn’t want to get it dirty’ (P # 8, L: 4302)

I coded children’s follow-up as *disagrees with caregiver’s response* when the child responded by saying ‘no,’ or ‘that’s not right.’

Example: *Disagrees with caregiver’s response*

CHILD QUESTION: ‘How come we are walking down Madison St.? ’ (P # 32, L: 1233)

CAREGIVER RESPONSE: ‘We’re not walking Madison’ (P # 32, L: 1234)

CHILD REACTION: ‘Well we are. That is Madison St.’ (P # 32, L: 1263)

*Provides additional on-topic details* was coded when a child provided additional details to the caregiver’s response or provided additional details about the original question.

Example: *Provides additional on-topic details*

CHILD QUESTION: ‘Is he coming over by bus?’ (P # 11, L: 392)

CAREGIVER RESPONSE: ‘He's goin(g) on the bus with us an(d) he's gonna walk to school with us.’ (P # 11, L: 393)

CHILD REACTION: ‘And he is gonna go into our class.’ (P # 11, L: 394)

Inter-rater reliability was established using a randomly selected sample of 20% of the transcripts. A research assistant and I independently coded the transcripts (one researcher coded 100% of the transcripts, while the other coded 20% of transcripts that were randomly selected). Coders were blind to the SES of the family. Overall agreement
was 90% (Cohen’s Kappa .84), which according to Landis & Koch (1977) is a ‘near perfect’ (0.81 or above) level of reliability. Discrepancies were resolved through discussion.

**Results**

For all phases of the exchange, the data set was split by group (mid-SES and low-SES). In keeping with Child Language data analytic techniques, the data was pooled across children in each group, making the utterance instead of the child the basic unit of analysis. This strategy has been used in several studies (Batsch, Horvath & Estes, 2003; Frazier, Gelman and Welman 2009; Sobel, Li & Corriveau, 2007) and meets the requirement of independence needed to conduct statistical analyses as defined by Bakeman and Gottman (1997) who suggest that consecutive events (e.g., multiple utterances from the same child) measured in naturalistic settings are considered independent as long as (a) observers make separate (and presumably independent) decisions when coding each event, and (b) the coding system consists of mutually exclusive and exhaustive categories. Both of these conditions applied to the coding scheme that was used.

**Children’s questions.** Children from mid-SES families asked a total of 684 questions, while children from low-SES families asked a total of 388 questions. To examine differences in the types of questions children ask across the two groups, I first calculated the proportion of each types of question asked by children in each group. Proportions were found by dividing the frequency of the type of question asked by the total number of questions asked by children within the group (shown in parentheses in
Table 2.1. Calculating these proportions controls for any differences observed due to the number of questions asked by children in each group. When comparing the two groups, an omnibus chi-square revealed no significant differences in the types of questions children ask $\chi^2 (2, \text{N}=1,071) = 0.132, n.s.$ A similar proportion of fact-based, causal and action-seeking questions were asked by children from mid-SES and low-SES families.

<table>
<thead>
<tr>
<th></th>
<th>Mid-SES</th>
<th>Low-SES</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Information seeking</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fact-based</td>
<td>503 (73.5%)</td>
<td>283 (72.9%)</td>
<td>786</td>
</tr>
<tr>
<td>Causal</td>
<td>86 (12.6%)</td>
<td>48 (12.4%)</td>
<td>134</td>
</tr>
<tr>
<td><strong>Non-information seeking</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Permission seeking</td>
<td>27 (3.9%)</td>
<td>25 (6.4%)</td>
<td>52</td>
</tr>
<tr>
<td>Action Seeking</td>
<td>68 (9.9%)</td>
<td>32 (8.2%)</td>
<td>100</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>684</td>
<td>388</td>
<td>1,072</td>
</tr>
</tbody>
</table>

Initially, I planned to use a similar approach as Chouinard (2007) and collapse across fact-based and causal questions to create an information seeking questions category. However, upon further inspection of Table 2.1 and follow-up McNemar’s tests, it became clear that within each group (mid-SES and low-SES) there was a significant difference in the proportion of causal and fact-based questions (Mid-SES, $\chi^2 (1, \text{N} = 684) = 7.1, p < .01$; Low-SES, $\chi^2 (1, \text{N} = 388) = 6.5, p < .01$). Both mid-SES and low-SES
children asked significantly more fact-based questions than causal questions, therefore collapsing across these categories would cause considerable differences in further analyses of adult responses and children’s follow-up to be lost. Therefore, in all subsequent analyses, responses to fact-based questions and to causal questions will be considered separately.

**Caregiver’s responses to information-seeking questions.** To explore one of the primary hypotheses that differences would exist between mid-SES and low-SES families in the types of explanations children receive to their information-seeking questions, I compared caregiver’s responses to information seeking questions. Because the aims of this study are to explore how children use questions for learning, action-seeking questions were excluded from analyses. Moreover, because different types of questions likely required different types of responses, I first explored caregivers’ responses to fact-based questions, those that required less sophisticated responses, before turning to responses to causal questions. Given that previous work exploring children’s question asking behaviors has found that there are no significant differences in the number of fact-based questions children ask across diverse groups (children across diverse backgrounds have been found to ask an average of 76 information seeking questions per hour (Chouinard, 2007), here I predicted that no differences would exist between mid-SES and low-SES caregivers’ responses to fact-based questions.

**Responses to fact-based questions**

I began by exploring responses to fact-based questions, which typically require less sophisticated responses. Inspection of Table 2.2 reveals no differences in the types of
responses caregivers’ offered. Indeed, a similar proportion of each type of response was offered by mid-SES and low-SES families. To confirm this, an omnibus chi-square was performed ($\chi^2 (3, N=881) = 6.9, n.s.$). Both Mid-SES and Low-SES caregivers provided a similar proportion of on topic responses, when no explanation was needed (48.9% and 45.6% respectively). This is likely because fact-based questions (e.g., ‘what is that?’) do not require extensive explanations and therefore on topic responses with no explanation are the most appropriate type of response for these types of questions. Similarly, when looking at on topic responses with explanations, both mid-SES and low-SES caregivers provided a similar proportion of responses (4.2% and 2.8% respectively). This was the lowest proportion of responses given by low-SES caregivers and second lowest offered by mid-SES caregivers. This response pattern looked similar when looking at the on topic no explanation given category. Indeed, only 3.7% of mid-SES caregivers’ responses comprised on topic no explanation given whereas 4.4% of low-SES caregiver responses were on no topic no explanation given. Both of the two aforementioned categories on topic with explanation; on topic no explanation given) look at whether an explanation was included in the response that was given. It seems likely that the low proportion seen across groups in these two categories is likely due to the fact that fact-based questions do not require extensive explanations and therefore there were not many opportunities for caregivers to provide explanations. When looking at the remaining three categories (unrelated, turns question back and no responses) slightly more variation was observed between the two groups. Note, these differences were not significant. Indeed, 9.7% of mid-SES caregiver responses were unrelated compared to 11.7% of low-SES caregivers’
responses. Turns question back comprised 16.6% of responses offered by mid-SES caregivers and only 13.3% of responses offered by low-SES caregivers. Lastly, 16.7% of mid-SES caregivers provided no response when asked a fact-based question, compared to 21.8% of low-SES caregivers.

Table 2.2. Caregivers’ responses to fact-based questions

<table>
<thead>
<tr>
<th>Response to fact questions</th>
<th>Mid-SES</th>
<th>Low-SES</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>On topic no explanation needed</td>
<td>277 (48.9%)</td>
<td>144 (45.6%)</td>
<td>421</td>
</tr>
<tr>
<td>On topic with explanation</td>
<td>24 (4.2%)</td>
<td>9 (2.8%)</td>
<td>33</td>
</tr>
<tr>
<td>On topic no explanation given</td>
<td>21 (3.7%)</td>
<td>14 (4.4%)</td>
<td>35</td>
</tr>
<tr>
<td>Unrelated</td>
<td>55 (9.7%)</td>
<td>37 (11.7%)</td>
<td>92</td>
</tr>
<tr>
<td>Turns question back</td>
<td>94 (16.6%)</td>
<td>42 (13.3%)</td>
<td>137</td>
</tr>
<tr>
<td>No response</td>
<td>95 (16.7%)</td>
<td>69 (21.8%)</td>
<td>27</td>
</tr>
<tr>
<td>Total</td>
<td>566</td>
<td>316</td>
<td>881</td>
</tr>
</tbody>
</table>

In order to look at children’s follow-up to caregivers’ responses to fact-based questions, response types were collapsed across four categories: a) exemplary b) satisfactory c) unsatisfactory d) turns question back. These groups were created to make subsequent analyses of children’s follow-up more interpretable. Exemplary comprised on-topic with explanation responses, satisfactory consisted of response on topic with no explanation and response on topic no explanation needed, while unsatisfactory comprised unrelated and no response. Turns question back was retained as a distinct category because these responses may be interpreted as unsatisfactory or satisfactory by
children. Figure 2.2 displays the proportion of response types offered by mid-SES and low-SES caregivers. When exploring these four categories, no significant differences were found between mid-SES and low-SES families ($\chi^2 (3, N=881) = 6.57, n.s.$). The most typical response type offered by both groups were satisfactory responses (52% and 50% respectively). Given that no significant differences were found, these data suggest that caregivers across groups typically provide satisfactory responses to less complex questions.

![Bar chart showing proportion of caregivers' responses to fact-based questions]

**Figure 2.2.** Proportion of caregivers’ responses to fact-based questions

**Responses to Causal Questions**

To explore caregiver’s responses to causal questions, I began by exploring the different types of responses and comparing them across groups (Table 2.3). An omnibus chi square revealed significant differences in the types of responses offered by mid-SES
and low-SES caregiver’s ($\chi^2 (5, N=155) = 13.08, p < .05$).

Table 2.3. Caregivers’ responses to causal questions

<table>
<thead>
<tr>
<th>Response to causal questions</th>
<th>Mid-SES</th>
<th>Low-SES</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>On topic no explanation needed</td>
<td>11 (10.67%)</td>
<td>1 (2.1%)</td>
<td>12</td>
</tr>
<tr>
<td>On topic with explanation</td>
<td>32 (31.1%)</td>
<td>11 (21.2%)</td>
<td>43</td>
</tr>
<tr>
<td>On topic no explanation given</td>
<td>13 (12.6%)</td>
<td>17 (32.7%)</td>
<td>30</td>
</tr>
<tr>
<td>Unrelated</td>
<td>16 (15.5%)</td>
<td>6 (11.5%)</td>
<td>22</td>
</tr>
<tr>
<td>Turns question back</td>
<td>15 (14.2%)</td>
<td>6 (11.5%)</td>
<td>21</td>
</tr>
<tr>
<td>No response</td>
<td>16 (15.5%)</td>
<td>11 (21.2%)</td>
<td>27</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>103</td>
<td>52</td>
<td>155</td>
</tr>
</tbody>
</table>

To better understand the difference in responses to causal questions, post-hoc analyses were conducted. Using an approach first described by Beasley & Schumaker (1995), z-scores were calculated and compared to chance. Post-hoc analyses revealed statistically significant differences in the proportion of on-topic no explanation given (12.6% vs. 32.7%, $z = 3.0, p<.05$). All other post-hoc tests were not significant.

Next, I collapsed the responses across four categories. The same four categories used for responses to fact-based questions were retained (exemplary, satisfactory, unsatisfactory and turns question back). The only exception was that in the case of fact-based questions, the no explanation needed category was considered a satisfactory response and included in all analyses.
Here, because I was interested in causal questions, which typically require longer explanations, the *no explanation needed* category was removed from the following analyses. When comparing differences by SES in the proportion of responses across these four categories an omnibus chi-square revealed significant differences ($\chi^2 (3, N=143) = 8.15, p < .05$) (See Figure 2.3.) Post hoc analyses revealed that mid-SES caregiver’s provided a significantly higher proportion of exemplary responses (34.7% vs. 21.6%, $z=1.98$, $p<.05$) to children’s causal questions, whereas low-SES caregiver’s provided a significantly higher proportion of satisfactory responses (33.33% vs. 14.13%, $z=2.7$, $p<.05$). No other significant differences were found. One plausible explanation for the difference in satisfactory responses is that these responses did not contain an explanation and therefore were more direct. Indeed, previous research has found that caregivers’ from low-SES families use more directive speech than mid-SES caregivers. I discuss this explanation further later in the discussion section.
Before investigating children’s reactions to caregivers’ responses, I examined the quality of caregivers’ responses. Specifically, I explored the quality of responses that included an explanation (56 mid-SES responses included explanations; 20 low-SES responses included explanations). Although explanations are generally perceived as a more sophisticated response, the quality of the explanation may impact how much knowledge the child acquires. It may also influence the child’s perception of the interlocutor (see Studies 2, 3 & 4, Chapter 3). As previously noted, I chose to look at
explanation circularity as a measure of explanation quality. Circular explanations, those that reiterate the question that was asked and do not provide additional information, are less ideal for learning. In contrast, non-circular explanations provide children with an elaborate response that are often used for the acquisition of new knowledge. Given Robinson and Rackstraw’s (1967) previous findings that suggest low-SES mothers provide circular responses, I predicted that when caregivers’ did provide an explanation, low-SES caregiver’s would use more circular explanations, whereas mid-SES caregiver’s would use more non-circular explanations. As predicted, mid-SES caregivers provided a significantly greater proportion of non-circular explanations than low-SES caregivers (77.5% of 56 mid-SES responses vs. 54% of 20 low-SES responses, \( \chi^2 (1, N=124) = 6.59, p=0.01 \) ) (See Fig. 2.4).
Figure 2.4. Quality of caregivers’ responses by SES

Children’s reactions. Arguably, if children use their questions for learning, they will not be satisfied with an inadequate response, and will persist until they receive a satisfactory answer. Indeed, Frazier, Gelman and Wellman (2009) proposed a similar hypothesis about children’s reactions to caregiver’s explanatory responses. Frazier et al. (2009) found that when children receive a non-explanatory response to a causal question, they are likely to re-ask their original question or provide their own explanation. In the current study I explored differences in patterns of children’s reactions to unsatisfactory responses to their information-seeking questions. When children receive answers that they consider satisfactory, one would expect them to react in systematically different ways than when they receive answers that they consider less than satisfactory. I first
began by exploring children’s reactions to responses given to their fact based questions, where there was little variability in the quality and types of responses they received.

*Children’s Reactions to Fact-Based Responses*

I explored children’s reactions to the four categories that were created from caregivers’ responses (exemplary, satisfactory, unsatisfactory and turns questions back). Note, the most typical follow-up responses included repeating the original question, following-up for elaboration, providing more details to the adult’s responses, agreeing with the adult responses and providing their own explanation. Children seldom disagreed with the caregiver. There was a lot of variability in the types of reactions mid-SES children had to exemplary responses. For example, 33% of their responses included providing their own details. Both mid-SES and low-SES children appeared to ask follow-up questions for elaboration most often (mid-SES, 33% vs. low-SES, 100%). Note that the low-SES percentage should be interpreted with caution, given that there was only 1 follow-up to an exemplary response. Given the small sample size, analyses were not performed.

Next, I looked at children’s reactions to satisfactory responses. Again, no significant differences were found between the two groups ($\chi^2(6, N= 101) = 6.1, n.s.$). Both mid-SES and low-SES children had a range of reactions. The most common reaction to satisfactory responses from both groups was to ask a follow up question for elaboration (mid-SES, 51.6% vs. low-SES, 59%). This reaction is similar to exemplary responses. It is likely because children look to continue the conversation after receiving a satisfactory response.
Next, I explored children’s reactions to unsatisfactory responses. There were also no significant differences when looking at reactions to unsatisfactory responses ($\chi^2 (6, N=154) = 5.32, n.s.$). In both groups, when children received an unsatisfactory response, they were likely to re-ask their original question (mid-SES, 43% vs. low-SES, 37.7%).

Finally, I explored children’s reactions when the adult turns the question back. There were no significant differences by SES group ($\chi^2 (5, N=80) = 3.62, n.s.$). Similar to children’s reactions to exemplary and satisfactory responses, when caregiver’s turned the question back, children across both groups were most likely to ask a follow-up question for elaboration (mid-SES, 32.2% vs. low-SES, 28.6%), indicating engagement in the conversation.

Table 2.4. Frequency and within group percentage of types of child reactions following adult responses to fact-based questions

<table>
<thead>
<tr>
<th></th>
<th>Agree</th>
<th>Follow-up</th>
<th>Repeat</th>
<th>Own-</th>
<th>Provides</th>
<th>No</th>
<th>Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
<td>explanation</td>
<td>Question</td>
<td>explanartion</td>
<td>more details</td>
<td>Response</td>
<td>%</td>
</tr>
<tr>
<td><strong>Mid-SES</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exemplary</td>
<td>1 (16.7%)</td>
<td>2 (33.3%)</td>
<td>1 (16.7%)</td>
<td>0 (0%)</td>
<td>2 (33.3%)</td>
<td>0 (0%)</td>
<td>0 (%)</td>
</tr>
<tr>
<td>Satisfactory</td>
<td>4 (6.5%)</td>
<td>32 (51.6%)</td>
<td>13 (21%)</td>
<td>2 (3.2%)</td>
<td>9 (14.5%)</td>
<td>1 (1.6%)</td>
<td>1 (1.6%)</td>
</tr>
<tr>
<td>Unsatisfactory</td>
<td>1 (1.2%)</td>
<td>33 (35.5%)</td>
<td>40 (43%)</td>
<td>12 (12.9%)</td>
<td>3 (3.2%)</td>
<td>3 (3.2%)</td>
<td>1 (1.6%)</td>
</tr>
<tr>
<td>Turns question back</td>
<td>9 (15.3%)</td>
<td>19 (32.2%)</td>
<td>7 (11.9%)</td>
<td>4 (6.8%)</td>
<td>13 (22%)</td>
<td>7 (11.9%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td><strong>Low-SES</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exemplary</td>
<td>0 (0%)</td>
<td>1 (100%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Satisfactory</td>
<td>3 (7.7%)</td>
<td>23 (59%)</td>
<td>2 (5.1%)</td>
<td>1 (2.6%)</td>
<td>9 (23%)</td>
<td>0 (0%)</td>
<td>1 (2.6%)</td>
</tr>
<tr>
<td>Unsatisfactory</td>
<td>1 (1.6%)</td>
<td>21 (34.4%)</td>
<td>23 (37.7%)</td>
<td>13 (21.3%)</td>
<td>3 (4.9%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Turns question back</td>
<td>2 (9.5%)</td>
<td>6 (28.6%)</td>
<td>3 (14.3%)</td>
<td>1 (4.8%)</td>
<td>4 (19%)</td>
<td>5 (23.8%)</td>
<td>0 (0%)</td>
</tr>
</tbody>
</table>
Children’s Reactions to Causal Responses

Children’s reactions to causal responses were coded in a similar manner using four response-type categories (exemplary, satisfactory, unsatisfactory and turns question back). Recall that the no explanation needed category was not included in the composition of satisfactory responses for causal questions. I anticipated that there would be more variability in these types of reactions because causal questions are more complex and thus children likely anticipate more complex responses. Indeed, children’s follow-up to caregivers’ responses to causal questions varied across groups. Inspection of Table 2.5 reveals that children from mid-SES caregivers provided more details following exemplary responses (66.7%) than low-SES caregiver’s (50%), although when looking at reactions to exemplary responses, no significant differences were found (p = 0.2, Fischer’s exact test). Again, this lack of a difference between groups should be interpreted with caution due to the low number of follow-up responses in both groups. In the low-SES group there were only 2 instances of follow-up after an adult’s exemplary responses, whereas mid-SES children followed up 6 times.

When looking at reactions to satisfactory responses, mid-SES children repeated their original question most frequently (100%) whereas low-SES children showed a range of responses (33% follow-up for elaboration; 33% provided their own explanation, 33% provided more details). Recall that satisfactory responses included a response that was on topic that did not include an explanation. Given that causal explanations likely require an explanation, this type of response may be perceived by the child as satisfactory, because it provides on-topic information, or unsatisfactory, because it does not include an
Children’s responses indicate that children from mid-SES families clearly viewed these responses as unsatisfactory by consistently repeating their original questions, whereas children from low-SES families had more variability in their responses, suggesting they may be more willing to accept these responses as satisfactory. Nevertheless, there was no significant difference between the two groups’ reactions to satisfactory responses to causal questions ($p = 0.6$, Fischer’s exact test).

Significant differences emerged when exploring reactions to unsatisfactory responses ($\chi^2 (4, N=41) = 10.45, p<.05$). Post-hoc analyses revealed that children from mid-SES families provided their own explanations significantly more than children from low-SES families (39.1% vs. 0%, $z = 3.0, p<.05$). One plausible explanation for this difference is that children from mid-SES families have a more advanced understanding of causality and are therefore able to provide explanations. I explore this explanation further in later in the discussion.

Lastly, I had anticipated there would be differences in children’s reactions when the adult turns the original question back to the child responses, however, no significant differences were found ($\chi^2 (3, N=11) = 3.79, n.s.$). Note, because 0% of children’s follow-up consisted of the disagrees category, this category was removed from analyses. Inspection of table 2.5 reveals that both mid-SES children and low-SES children often reacted to these types of responses by providing additional on topic details (62.5% vs. 66.7%).
Table 2.5. Frequency and within group percentage of types of child reactions following adult responses to causal questions

<table>
<thead>
<tr>
<th></th>
<th>Agrees</th>
<th>Follow-up elaboration</th>
<th>Repeats Question</th>
<th>Own-explanation</th>
<th>Provides more details</th>
<th>No Response</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mid SES</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exemplary</td>
<td>0 (0%)</td>
<td>2 (33.3%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>4 (66.7%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Satisfactory</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>3 (100%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Unsatisfactory</td>
<td>0 (0%)</td>
<td>4 (17.4%)</td>
<td>9 (39.1%)</td>
<td>9 (39.1%)</td>
<td>1 (4.3%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Turns question back</td>
<td>2 (25%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>5 (62.5%)</td>
<td>1 (12.5%)</td>
</tr>
<tr>
<td><strong>Low-SES</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exemplary</td>
<td>0 (0%)</td>
<td>1 (50%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>1 (50%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Satisfactory</td>
<td>0 (0%)</td>
<td>1 (33.3%)</td>
<td>0 (0%)</td>
<td>1 (33.3%)</td>
<td>1 (33.3%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Unsatisfactory</td>
<td>0 (0%)</td>
<td>3 (16.7%)</td>
<td>12 (66.7%)</td>
<td>0 (0%)</td>
<td>2 (11.1%)</td>
<td>1 (5.6%)</td>
</tr>
<tr>
<td>Turns question back</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>1 (33.3%)</td>
<td>0 (0%)</td>
<td>2 (66.7%)</td>
<td>0 (0%)</td>
</tr>
</tbody>
</table>

**Discussion**

The results of this study reveal that children across diverse backgrounds ask a similar proportion of questions for knowledge acquisition. Indeed, children from mid-SES and low-SES families asked a comparable proportion of fact-based questions and causal questions. This finding is consistent with previous work that demonstrates children across diverse backgrounds ask a similar proportion of information-seeking questions per hour (Chouinard, 2007). Chouinard (2007) coded information-seeking as both fact-based and explanatory questions (in the present study these were coded as causal questions). Although Chouinard (2007) did not explicitly look at differences by socioeconomic
background, her sample comprised a diverse range of individuals (working class and middle class families). This study confirms Chouinard’s (2007) findings and suggests that children across diverse backgrounds use questions as a mechanism for acquiring information from others. Below, I review the findings from the question, response, follow-up pattern for fact-based questions, and for causal questions. Next, I offer several explanations for some of these differences. I conclude by discussing the relationship between these differences in conversation style, knowledge acquisition, and school readiness in low-SES and mid-SES children.

When looking at caregivers’ responses to fact-based questions, no significant differences were found between the types of responses offered by mid-SES and low-SES caregivers. Indeed, both mid-SES and low-SES caregivers offered a similar proportion of exemplary, satisfactory, unsatisfactory and turns question back responses. The most typical response for each group was satisfactory. Recall, this category collapsed response on topic no explanation needed, with responses on topic no explanation. In contrast, the lowest proportion of responses offered by each group were exemplary. Given the nature of fact-based questions, it makes sense that satisfactory responses were offered most frequently to fact-based questions.

Given the lack of variability in caregivers’ responses to fact-based questions and that the majority of responses were satisfactory, I did not anticipate that there would be significant differences in children’s follow-up to caregivers’ responses. Indeed, no significant differences were found. Children across both groups expressed a range of responses. When presented with satisfactory responses, children across both groups
responded most frequently by asking a follow up question for elaboration, as if to keep the conversation going. When children received an unsatisfactory response, mid-SES and low-SES children both repeated their original question. These responses appear to indicate that children knowingly use their questions to acquire knowledge and expect a particular type of response. Thus when a satisfactory response is not given, children are more likely to re-ask their original question. Given that fact-based questions are less complex than other types of questions (e.g., causal) satisfactory responses are more obvious than unsatisfactory responses, making it clear to children how they should respond.

In contrast, causal questions are more complex, and therefore one might expect to see more variability in caregiver’s responses and children’s follow-up. Indeed, when comparing caregiver responses to causal questions, mid-SES caregivers provided significantly more exemplary responses. Somewhat surprisingly, low-SES caregivers provided more satisfactory responses. Recall, satisfactory responses for causal questions only included responses where an on-topic answer was given but no explanation was provided, which likely explains the difference observed between mid-SES and low-SES caregivers in the proportion of satisfactory responses they offered. Not only did mid-SES caregivers provide responses that included more explanations, it appeared as though instead of offering responses that did not contain an explanation, caregivers responded more frequently by turning the question back to the child. This response type was not as common with low-SES caregivers. Given these differences with response type, I expected to see differences in children’s follow up.
When looking at children’s follow-up to the responses given to their causal questions, mid-SES children exhibited a similar pattern to those found by Frazier, Gelman and Wellman (2009). Indeed, when looking at children’s responses to unsatisfactory responses, mid-SES children frequently responded by repeating their original question or by providing their own explanation. Low-SES children also repeated their original question, but provided their own explanations significantly less than mid-SES children. This response indicates that children are not simply trying to extend their conversation with adults, but actively seeking the information needed to answer their question. Somewhat surprisingly no significant differences were found when looking at follow-up to satisfactory responses. Mid-SES children repeated their original question 100% of the time, whereas low-SES children demonstrated a range of responses. I hypothesize that the lack of variability in mid-SES children was likely due to how satisfactory responses were grouped. It is plausible that children perceived on topic responses without explanations as unsatisfactory, because they have developed a sophisticated understanding that causal questions require explanations. To test this hypothesis, I re-ran the analysis, including on topic with no explanation in the unsatisfactory category. This regrouping yielded significant differences in children’s follow-up to unsatisfactory responses ($\chi^2 (3, N=47) = 15.6, p < .01$). When looking at follow-up to exemplary and turns question back, no significant differences were found.

Why might these differences exist between mid-SES and low-SES families? These findings are consistent with previous work which suggest that in general, low-SES families engage in less elaborative discourse and are more directive in their speech
patterns (Hart & Risley, 1992 & Hart & Risley, 1995). In the current study, responses that included explanations were longer and less direct, while on topic responses with no explanation (typically only several words) tended to be more direct. Mid-SES caregivers tended to provide explanations more frequently than low-SES caregivers. This difference is potentially problematic, especially if children are using the explanations as a tool for acquiring new knowledge. It is likely that longer explanations provide children with more information and, in turn, more knowledge.

A second plausible explanation for why low-SES caregivers’ may not provide explanations as frequently to their children’s causal questions is the lack of knowledge needed to answer their children’s questions. Indeed, some causal questions require complex answers that caregivers might not have access to. In the current study, mid-SES caregivers provided significantly more high quality responses (non-circular) than low-SES caregivers. This difference demonstrates a potential difference in knowledge. Low-SES caregivers may be more likely to provide circular explanations (those that reiterate the question) because they do not know the answer to the question their child asked.

A third explanation for these differences is that children from mid-SES families are exposed to more complex language that likely includes complex explanations (Snow & Uccelli, 2009) which may lead to a more developed understanding that causal questions require explanatory responses. Indeed, studies looking at children from Mid-SES families show that beginning around age 4, children begin to provide explanations that may help in their understanding of causal mechanisms (Kuhn & Katz, 2009; Legare, Wellman & Gelman, 2010; Rittle-Johnson, Saylor, & Swygert, 2008). The current study
demonstrates that children from low-SES families may be at a significant disadvantage in their understanding of causality and what the appropriate responses are to causal questions.

What does this mean for knowledge acquisition prior to the onset of formal schooling? By implication mid-SES children have more access to causal mechanisms and the skills needed to acquire this type of information. This understanding of causal mechanisms is likely linked to gains in critical thinking, metalinguistic and metacognitive skills that are crucial in today’s classroom (Valle, 2009). Indeed, children who have the ability to reason about cause and effect relationships have demonstrated more sophisticated critical thinking skills (Kuhn, 2002). Thus, the findings here reveal other significant discrepancies between mid-SES and low-SES children aside from vocabulary that children face when entering the classroom for the first time. It is important for teachers to be sensitive to these differences and to encourage children to follow-up when they receive unsatisfactory responses.

These findings raise a number of important questions for future research. First, why do differences exist in the types of explanations caregivers from diverse sociocultural backgrounds provide? Can these differences be attributed to the kinds of learning opportunities a family provides a child? Indeed, these opportunities have been linked to the sociocultural organization of the home and what parents are trying to accomplish through their interactions with their child (Durkin, 1987; Heath, 1989). It would be interesting to know why these responses are so different.

Another open question from these data is how would children’s follow-up change
if they consistently received an unsatisfactory response? Children do not begin asking complex causal questions until around age 3 (Chouinard, 2007), therefore, their understanding of what makes a response satisfactory to these types of questions may also be emerging. Previous research suggests that by the age of 7, when children receive consistently unsatisfactory responses from an interlocutor (e.g., prohibitions) they are less likely to turn to them in the future (Hart & Risely, 1995). I expect that consistently receiving unsatisfactory responses will cause children to stop following up, and potentially cause them to stop using questions as a tool for learning from others.

Taken together, these findings suggest that the question, explanation, follow-up pattern of interaction that is often privileged in formal schooling might look different in children’s early interactions with caregivers. However because the analyses presented here were mostly exploratory, they must be interpreted with caution. Indeed, there are other factors that need to be considered. In particular, this sample also comprised children from diverse racial backgrounds. Although I chose to focus on SES, other sociocultural factors such as race often intersect with SES. Indeed preliminary analyses indicate no differences in the types of questions children ask based on race, but show differences in the types and quality of caregivers’ responses. Further analyses are needed to better understand these differences.

These findings add to the growing body of literature on mechanisms children use for learning from others (Harris & Koenig, 2006). These data make a novel contribution to this literature by demonstrating an important mechanism whereby this learning could potentially take place and how this mechanism looks different across diverse
sociocultural backgrounds. Although this study does not explicitly measure whether children learn from the explanations they receive, the results support the idea that children seek adult testimony and find some forms of responses more satisfying than others, which is marked by children’s follow-up.
Chapter 3: Differences in children’s use of explanations for learning from others

Introduction

The results from Study 1 suggest that children from diverse backgrounds purposely use questions as a tool to acquire knowledge from their caregivers. Some children ask more sophisticated questions that require extensive explanations while others use simple, fact-based, questions. Study 1 reveals significant differences in the types and quality of responses children hear in response to their questions. The responses children receive often contain the information needed to acquire new knowledge, but what else can they tell us about children’s learning? To gauge the effectiveness of adult responses one must know how the child who asked the question perceived the information they received. In Study 1 (Chapter 2) I explored children’s reactions to caregiver’s responses in every day conversations. Similar to previous findings (Frazier et al., 2009), children across diverse backgrounds reacted similarly when they received an unsatisfactory response. Yet, it is unclear from Study 1 (Chapter 2) if unsatisfactory responses influence children’s perceptions of the informant. Specifically, are the types of responses children received related to their perceptions of the credibility of an informant? Given previous research on children’s willingness to trust the testimony of informants, it is clear that children prefer...
to learn from an informant who had previously provided accurate information (Clément, Koenig & Harris, 2004; Koenig, Clément & Harris, 2004; Koenig & Harris, 2005). However, to date these studies have only focused on single-word learning, and not on longer explanations which children are likely to hear when using questions to learn about the world. In the current study I use experimental methods to explore how children use the quality of the responses they hear (specifically explanation circularity) to make judgments about an informants’ future credibility and how individual differences might contribute to differences in these judgments (See Fig. 3.1).

One of the primary goals of early childhood education is to provide children with the opportunity to acquire new social and epistemic information. When learning new information about the world, children have many sources available to them including their own, first-hand experiences and information provided to them by other people, either spontaneously or as result of inquiry. For example, in a classroom setting children are likely to have access to both types of information. In a lesson about gravity, children can have both the hands-on experience of dropping manipulatives to discover the effects of gravity on falling objects, as well as the experience of hearing scientific information about gravity provided by the classroom teacher, a trusted source.

However, there are many instances when first-hand experiences are either inefficient or unavailable. Under these circumstances, children must rely on others to learn about the world. Consider, for example, how children learn about the shape of the Earth. Although in principle, children could view Earth at a distance from space; this is clearly not the most efficient learning method (Harris & Koenig, 2006). Even more
challenging is children’s learning of historical information, where children are reliant on the oral and written accounts from individuals who experienced the events first-hand (Corriveau, Kim, Schwalen & Harris, 2009). To understand these concepts as well as unobservable phenomena, children must discover effective and efficient learning strategies for evaluating the source providing the information.

Children are surprisingly selective when deciding from whom to learn. By early preschool, children rely on multiple cues when determining informant credibility, such as prior accuracy in a particular domain, benevolence, and social group status (e.g., Corriveau & Harris, 2009ab; Corriveau, Fusaro & Harris, 2009; Corriveau, Kinzler & Harris, 2013; Harris, 2012; Kinzler, Corriveau & Harris, 2011; Koenig & Woodward, 2010; Mascaro & Sperber, 2009).

To date, studies on children’s selective learning have largely focused on how children use an informant’s accurate or inaccurate labeling of a familiar object when subsequently deciding from whom to learn a novel fact: usually a novel object’s name or function (e.g., Birch, Vauthier & Bloom, 2008; Koenig & Harris, 2005). This focus on children’s evaluation of single-word utterances is surprising, given that preschoolers shift from primarily asking ‘what’ and ‘where’ questions, which can be answered with one-word responses, to asking ‘why’ and “how” questions, which require longer explanations (Isaacs, 1930; Chouinard, 2007; Frazier, Gelman & Wellman, 2009). The use of ‘how’ and ‘why’ questions to acquire information is observed across diverse groups in Study 1 (Chapter 2) of this dissertation. Indeed, not only do preschool children begin to ask questions that call for causal explanations, but they also begin to provide explanations
that may help in their understanding of causal mechanisms (Kuhn & Katz, 2009; Legare, Wellman & Gelman, 2010; Rittle-Johnson, Saylor, & Swygert, 2008).

Based on preschooler’s developing understanding of the role of explanations in learning, it seems likely that children would determine an informant’s future credibility by attending not only to her single-word utterances, but also to her explanations. Indeed, recent research indicates that preschoolers can make judgments about the quality of explanations. Mercier, Bernard and Clément (2014) demonstrated that children as young as 3 weigh the quality of explanations when making subsequent decisions. Mercier et al. (2014) presented 3-, 4- and 5-year-olds with a series of vignettes where two speakers offered contradictory arguments (task 1: argument supported by perceptual evidence (strong argument) v. circular argument (weak argument); task 2: weak argument v. no argument). Whereas all age groups endorsed the strong argument, only 4- and 5-year-olds endorsed the weak argument over no argument.

The data from Mercier et al. (2014) suggest that even young preschoolers can use explanation quality to make decisions. Nevertheless, little is known about the developmental origins of children’s use of these evaluations to make inferences about source credibility. Here, I present the first set of studies exploring children’s use of explanation quality to evaluate an informant’s credibility.

The task of evaluating explanations to determine informant credibility is more complex than evaluating single utterances. Children need to compare the speaker’s utterance to their own background knowledge, as well as to evaluate the internal coherence of the statement (e.g., Harris, Kruithof, Meerum Terwogt & Visser, 1981;
Markman, 1979). These tasks are difficult even for adults and older children (e.g., Mercier, 2012). For example, Baum, Danovitch and Keil (2008) presented 5-10-year-olds with explanations for why natural phenomena occur (e.g. why polar bears are white): a circular explanation, and a noncircular explanation. Whereas 5-year-olds had a fragile preference for noncircular explanations, 10-year-olds displayed a robust preference. Similarly, Bernard, Mercier and Clément (2012) presented 3–5-year-olds with two speakers who provided differing explanations for the location of a hidden object. One explanation included the causal connective because, whereas the other explanation used the phatic term well object (e.g. the ball is in “the blue box because Camille always puts her ball in the blue box.” and “Well, Camille always puts her ball in the blue box.”) Four- and 5-year-olds searched in the location identified by the speaker using causal connectives. Taken together, these studies suggest that children’s evaluation of explanatory coherence develops over the preschool and elementary school years.

Like in Study 1 (Chapter 2) of this dissertation, in the current set of studies, I focus on argument circularity as a marker of explanatory coherence (explanation quality). As previously noted, circular explanations refer to statements that reiterate the information from the original question without adding new information. By contrast, non-circular explanations provide more information than was provided in the original question. I chose to focus on explanation circularity for several reasons. First, manipulating argument circularity allowed me to focus on the abstract structural properties of explanations, rather than on the content of the explanation themselves. Second, adults and older children selectively prefer non-circular explanations (Baum et
Circular explanations are ubiquitous in everyday conversation, suggesting that most preschoolers have been exposed to this type of explanatory structure. Finally, manipulating argument circularity allowed me to hold other markers of explanation complexity constant, such as utterance length, reading ease, and vocabulary difficulty.

Even if young children can monitor for argument circularity, do they use this information to make evaluations about an informant’s future credibility? On the one hand, given that the task of evaluating explanation quality is taxing for young children, it is possible that children’s evaluations will not extend to inferences about informant credibility. On the other hand, extensive research suggests that children use an informant’s prior behavior to make such inferences at the single-word level (e.g., Harris & Corriveau, 2011). If children use similar mechanisms when evaluating explanations, they might also evaluate the source of the non-circular explanation as more credible. The present set of studies aimed to evaluate children’s developing understanding of explanatory coherence, as well as to assess children’s preference for learning future information from the explanation’s source.

A second goal of this research was to determine if children’s preference for explanatory coherence varied based on environmental factors. A tremendous amount of work has documented individual differences in children’s linguistic environment as a function of the mother’s socioeconomic status (SES) and education level (Hart & Risley, 1995; Hoff, 2003; Tizard & Hughes 1984; Snow, 1991). Individual differences in early exposure to complex language are related to differences in the complexity of language
production (Huttenlocher et al., 2002; Huttenlocher, Vasilyeva, & Shimpi, 2004), as well as differences in syntactic comprehension and verbal growth (Huttenlocher et al., 2002).

In Study 1 (Chapter 2) of this dissertation, I found significant variability in the quality of explanations children from diverse socioeconomic backgrounds were exposed to. Indeed, caregiver’s from low-SES backgrounds provided significantly more circular explanations than mid-SES caregivers. Moreover, in a recent experimental study, I found that children from low-SES families prefer explanations that use active voice construction which are arguably of lower quality compared to explanations that use passive voice construction (Corriveau & Kurkul, in prep). I suggest that these differences might be due to exposure. Indeed, mid-SES children have been found to be exposed to more story-books which often use the passive-voice construction than low-SES children (Hoff, 2003). In Study 4 of the current set of studies, I compared the selective learning preferences of children of low-SES (as measured by eligibility for school vouchers) and mid-SES (as measured by non-eligibility for school vouchers). On the one hand, circular explanations are ubiquitous in everyday conversations, making it equally as likely that children from low-SES and mid-SES will be exposed to this pattern of talk. On the other hand, it has been well documented that children of mid-SES families have more opportunities to engage learning activities that require non-circular explanations (e.g., literacy activities; science activities at museums) (Bartin et al., 2001; Callanan, 2012). Given these differences in exposure, I asked whether children of mid-SES would privilege an informant who uses passive voice more than children of low-SES.

In Study 2, 3- and 5-year-olds were presented with pictures of two informants and
tested in two phases. Note, although the informants were strangers, previous research suggests that children are just as likely to direct their questions to strangers as they are to caregivers (Chouinard & Imberi-Olivares, 2011), therefore, it is plausible that children will likely ask questions to strangers and evaluate the explanations they provide. In the training phase, both informants provided explanations for familiar entities. Although the entities were familiar to the children, the causal explanations were not. In each of 4 trials, one informant consistently provided a non-circular explanation, whereas the other informant provided a circular explanation. Children were invited to endorse one of the two explanations.

In the test phase, the informants provided conflicting information about novel entities. In the novel explanations task, informants provided conflicting non-circular explanations about a novel object. In the novel labels task, informants provided conflicting labels for a novel object. Finally, children were asked to explicitly judge the credibility of the two informants.

Three separate but related predictions were made. First, if children are able to judge the quality of the explanation, they should selectively prefer the non-circular (high-quality) over the circular (low-quality) explanation in training trials. Second, if children are able to use explanation quality to make inferences about the informants’ future credibility, they should prefer to learn from the informant who had previously provided non-circular over circular explanations. Finally, individual differences in children’s preference for non-circular explanations during the training trials should be related to their selective learning from the two informants in test trials.
Study 2

Method

Participants. Thirty-three children participated in the study: 17 3-year-olds (7 female, $M = 3;7, SD = 5$ months; range: 3;2–4;2) and 16 5-year-olds (10 female, $M = 5;1, SD = 4$ months; range: 4;10–6;0). Children spoke English as their first language, and were recruited from a local preschool (Apple Orchard in Brookline, MA) and museum (Museum of Science, Boston, MA). Ninety-percent were white; 10% were Asian-American. Although information on socioeconomic status was not collected, the preschool and museum serve a predominantly middle and upper-middle class population.

Materials. Children sat at a small table located in the corner of a quiet room where an experimenter presented two pictures of females wearing differently-colored shirts (black, green). The females were matched for attractiveness and displayed neutral affect. During the training trials, 4 pictures of familiar entities were used (e.g. polar bear, car, rain, plant). During the novel explanations and novel labels tasks, eight pictures of novel objects were used (see Table 3.1).
Table 3.1 *Stimuli Used for Novel Explanations and Novel Labels Trials in Studies 2, 3 and 4*

<table>
<thead>
<tr>
<th>Novel objects</th>
<th>Informant 1 response</th>
<th>Informant 2 response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Novel Explanations</td>
<td>Plastic hook: It has a triangle in the middle so we can see through it.</td>
<td>It has a triangle in the middle so we can put our fingers through it.</td>
</tr>
<tr>
<td></td>
<td>Metal hook: It has hooks so that we can hang scarves on it.</td>
<td>It has hooks so that we can hang hats on it.</td>
</tr>
<tr>
<td></td>
<td>Sprinkler head: It is shiny so that we can see it from far away.</td>
<td>It is shiny so that it looks bright like the sun.</td>
</tr>
<tr>
<td>Novel Labels</td>
<td>Car Medallion: That’s a nez</td>
<td>That’s a cray</td>
</tr>
<tr>
<td></td>
<td>Black door hinge: That’s a modi</td>
<td>That’s a seebo</td>
</tr>
<tr>
<td></td>
<td>Citrus juicer: That’s a foppick</td>
<td>That’s a tillen</td>
</tr>
<tr>
<td></td>
<td>Red retractable funnel: That’s a rossi</td>
<td>That’s a bobe</td>
</tr>
</tbody>
</table>

**Procedure.** All children participated in 4 trial types: (a) training (b) novel explanation (c) novel label (d) explicit judgment. Trials were presented in a fixed order, with the exception of the novel explanation and novel label trials, which were counterbalanced across participants.

**Training.** The experimenter began by presented pictures of the two informants and said, “Look at these girls. One is wearing a green shirt, and the other is wearing a black shirt. They are going to tell us about some things.” For each of four trials, the experimenter placed a picture of an entity between the informants and said, “Look, here is a picture of (e.g., rain). Now these girls think that they know why it rains. Let’s see
what they say.” In 5 cases, children offered unprompted explanations. No child’s explanation was similar to either the circular or non-circular explanation.

The experimenter pointed to both girls sequentially and stated their explanations. One informant always provided a non-circular explanation, whereas the other informant always provided a circular explanation (see Table 3.2, top panel, for examples of explanations).
Table 3.2 *Sample Explanations Used in Training in Studies 2, 3 and 4.*

<table>
<thead>
<tr>
<th>Event</th>
<th>Statement</th>
<th>Circular Explanation</th>
<th>Non-Circular Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Study 2</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rain</td>
<td>These girls think they know why it rains. Let’s see what they think.</td>
<td>Sometimes it rains because it is wet and cloudy outside, and water falls from the sky. When water falls from the sky it is called rain and it gets us all wet.</td>
<td>Sometime it rains because there are clouds in the sky that are filled with water. When there is too much water in the clouds it falls to the ground and gets us all wet.</td>
</tr>
<tr>
<td>Flowers/Trees</td>
<td>These girls think they know why trees and flowers grow. Let’s see what they think.</td>
<td>Flowers and trees grow because they become taller and taller. They grow when their stem gets long and they get more and more leaves.</td>
<td>Flowers and trees grow because we feed them water, which keeps them healthy and strong. The sun also helps them grow by giving them energy, which keeps them healthy and strong.</td>
</tr>
<tr>
<td><strong>Studies 3 &amp; 4</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rain</td>
<td>These girls think they know why it rains. Let’s see what they think.</td>
<td>It rains because water falls from the sky and gets us wet.</td>
<td>It rains because the clouds fill with water and get too heavy.</td>
</tr>
<tr>
<td>Flowers/Trees</td>
<td>These girls think they know why trees and flowers grow. Let’s see what they think.</td>
<td>They grow because their stems get longer and longer and they get taller.</td>
<td>They grow because we feed them water and the sun gives them light.</td>
</tr>
</tbody>
</table>

Explanations were drawn from elementary school science textbooks (Macmillan, 2006) and were matched for complexity using Flesch Reading Ease Scores (Flesch, 1948). There were no significant differences between the two types of explanations ($M_{circular} = 87, M_{noncircular} = 90.8, t(6) = 1.06, n.s.$), indicating that the explanations were of equal reading difficulty. Moreover, explanation difficulty was similar to the average
levels of 81.5 and 85.1 used by Baum et al. (2008). After hearing the explanations, the experimenter repeated both explanations and asked, “Why do you think (e.g., rain falls)?” Both verbal (e.g. “What the girl in the green shirt said”) and nonverbal (e.g., pointing) responses were accepted. The order of explanation and the informant providing the circular explanation was counterbalanced across participants.

**Novel Explanations.** Immediately following the fourth training trial, children participated in either the novel explanations or novel labels task. The experimenter said “Here are the same two girls again. Remember, this one is wearing a green shirt and this one is wearing a black shirt. They are going to explain some things that we don’t know about.” For each of the four trials, the experimenter placed a picture of a novel object between the informants, and said, for example, “Look at this object. Now I wonder why it has (e.g., a round thing there). Let’s see what these girls think” (see Table 3.1).

The experimenter pointed to both girls sequentially and stated their explanations. Both explanations were always non-circular and equivalent in plausibility. For example, “The girl in the green shirt says it has a round thing there so that we can spin it on the table.” and “The girl in the black shirt says it has a round thing there so that we can roll it on the table.” Immediately following the explanations, the experimenter repeated the two explanations and asked, “Why do you think (e.g., it has a round thing)”? The order of the explanations, and the informant offering each explanation was counterbalanced across participants.

**Novel Labels.** The experimenter began by saying, “Now the girls are going to tell us the names of some funny-looking things.” For each of the four trials the experimenter
placed a picture of a novel object between the informants and said, for example, “The girl in the green shirt says that’s a foppick” and “The girl in the black shirt says that’s a tillen.” (see Table 3.1, lower panel). The experimenter repeated the two labels, and asked, “What do you think it’s called?” The order of the labels, and the informant offering each label was counterbalanced across participants.

*Explicit Judgment.* Finally, the experimenter pointed to the picture of each informant and said “Do you remember when the girl in the green shirt was talking about some things that we know about like polar bears and rain? Was she very good or not very good at explaining those things?” The same question was posed for the girl in the black shirt (counterbalanced across participants). Finally, children were asked to judge the relative quality of the informants: “Which girl was better at explaining those things?”

**Results**

**Training Trials.** Table 3.3 displays the children’s mean preference for the informant providing non-circular explanations during the training trials along with comparisons with 50% chance performance. Responses offered by 5-year-olds were significantly different from those offered by 3-year-olds (*t* (31) = 5.56, *p* < .001, *d* = 0.97). Whereas 5-year-olds were above chance in choosing the non-circular explanations, 3-year-olds did not systematically choose either explanation.
Table 3.3 *Mean Scores (Standard Deviations), Comparisons with Chance Performance, and Effect Sizes in Study 2*

<table>
<thead>
<tr>
<th>Trial Type</th>
<th>3-year-olds</th>
<th>5-year-olds</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>T</td>
</tr>
<tr>
<td>Training score (max=4)</td>
<td>2.17 (.72)</td>
<td>1.00</td>
</tr>
<tr>
<td>Novel explanations (max=4)</td>
<td>2.52 (1.0)</td>
<td>2.17*</td>
</tr>
<tr>
<td>Novel labels (max=4)</td>
<td>1.94 (.75)</td>
<td>.32</td>
</tr>
<tr>
<td>Explicit judgment (max=3)</td>
<td>1.76 (1.25)</td>
<td>.78</td>
</tr>
</tbody>
</table>

Note. Mean scores indicate the number of trials on which the children preferred the non-circular explanation (on training trials) or the non-circular informant on the novel labels, novel explanations and explicit judgment tasks. Standard deviations are indicated in parentheses.

* p < .05, ** p < .01, *** p < .001

**Novel Explanations and Novel Labels.** Table 3.3 also displays children’s mean preference for the informant providing non-circular explanations and comparisons to 50% chance for both the novel explanations and the novel labels task. In the novel explanations task, both 3-year-olds and 5-year-olds performed above 50% chance, systematically endorsing explanations from the informant who had provided non-circular explanations. In the novel labels task, 5-year-olds were also above chance in privileging this informant. By contrast, 3-year-olds did not systematically choose either informant.

To confirm these findings, a 2 (Age Group: 3-year-olds, 5-year-olds) X 2 (Trial Type: novel explanations, novel labels) repeated-measures ANOVA was conducted. This analysis revealed a main effect of Age Group ($F(1,31) = 4.75, p < .05, \eta^2_p = .13$) and a Trial Type X Age Group interaction ($F(1,31) = 5.24, p < .05, \eta^2_p = .15$). The main effect
of Trial Type was not significant.

To interpret the interaction, the simple effect of Age Group was calculated for each trial type. On the novel explanations tasks, both 3- and 5-year-olds demonstrated similar levels of selectivity, preferring to endorse explanations from the informant who had previously offered non-circular explanations \((F(1,31) = .11, n.s.)\). By contrast, in the novel labels task, 5-year-olds were significantly more selective than 3-year-olds \((F(1,31) = 12.82, p < .001)\).

**Explicit Judgment.** Table 3.3 displays children’s average correct performance and comparison to 50% chance for the explicit judgment trials. Five-year-olds were significantly more likely than 3-year-olds to judge the non-circular informant as ‘better’ \((t(31) = 2.29, p < .05, d = 0.43)\). Whereas 5-year-olds systematically judged the informant giving non-circular explanations as ‘better’, 3-year-olds were at chance in judging the informants. Note that the data are similar when exploring the final forced-choice question only.

**Discussion**

In Study 2, I examined preschoolers’ developing preference for circular versus non-circular explanations. I also investigated children’s use of explanation type to determine an informant’s future credibility across two novel learning tasks. Although the explanations provided were not direct responses to children’s naturalistic questions, they were placed in the context of a question that child would likely ask (e.g., ‘Why does a polar bear have white fur?’).

First, children’s preference for non-circular explanations develops over the
preschool years. In the training trials, 3-year-olds displayed no systematic preference for non-circular explanations, whereas 5-year-olds selectively preferred the non-circular explanations. This finding is consistent with previous research indicating that 5-year-olds choose a non-circular explanation as the ‘best’ explanation for why something occurs (Baum et al., 2008, Experiment 1). Note that these data suggest that 5-year-olds’ evaluation of explanation quality extends beyond the evaluation of a single word (e.g., a causal connective ‘because’, Bernard et al., 2012). Both the non-circular and circular explanations included a causal connective; thus, if children were simply monitoring for such target words, they should have been at chance in evaluating the explanations.

Second, both 3- and 5-year-olds used the quality of an informant’s explanation when assessing her subsequent credibility. When asked to endorse a novel explanation, both 3- and 5-year-olds demonstrated a significant preference for learning from the informant who had provided non-circular explanations. Three-year-olds’ preference is impressive, given that they did not display a selective preference for either explanation type in the training trials. Nevertheless, children’s preference for learning from the informant who provided non-circular explanations is fragile in early preschool. Whereas 5-year-olds also preferred to learn novel labels from this informant, and to explicitly judge her as ‘better’, 3-year-olds displayed no systematic preference.

Why would 3-year-olds display selectivity in some test trials, but not in explicit judgment trials? One possibility is that 3-year-olds’ poor performance on the training trials, and subsequent fragile preference on test trials, was due to task demands. The explanations used in Study 2 were relatively long ($M = 27$ words). Note that I had
attempted to decrease memory load by repeating the two explanations prior to inviting the child to respond. Nevertheless, in Study 3, children’s explanation monitoring was probed further by decreasing the explanation length in the training trials.

**Study 3**

**Method**

**Participants.** Thirty-two different children participated in the study: 16 3-year-olds (14 female, \( M = 3;7, SD = 5 \) months; range: 3;3–4;3) and 16 5-year-olds (10 female, \( M = 5;7, SD = 4 \) months; range: 5;2–6;2). Children spoke English as their first language and were recruited from local preschools (Riverside in Newton, MA and St. Michael’s School in North Andover, MA). Seventy-five percent were white; 12.5% were Southeast Asian-American and 12.5% were East Asian-American. Although information on socioeconomic status was not collected, the preschools serve a predominantly middle and upper-middle class population.

**Procedure.** The procedure was identical to Study 2, with the exception of the explanations in the training trials (see Table 3.2, bottom panel). For all four training trials both the circular and non-circular explanations were matched for length (explanation length < 13 words), and for readability (Flesch, 1948). There were no significant differences in readability between the two types of explanations \( M_{circular} = 84.3, \ M_{noncircular} = 92.3, t(6) = 1.68, n.s. \), suggesting that, as in Study 2, the explanations were of equal reading difficulty. Moreover, there were no significant differences in the readability, when comparing the explanations from Studies 2 and 3.
Results

Training Trials. Table 3.4 displays mean preference for the non-circular explanations and comparisons to 50% chance. Both 5-year-olds and 3-year-olds were above 50% chance in choosing non-circular explanations. There were no significant differences between the responses given by 3-year-olds and 5-year-olds ($t(30) = 1.79$, n.s.).

Table 3.4 Mean Scores (Standard Deviations), Comparisons with Chance Performance, and Effect Sizes in Study 3

<table>
<thead>
<tr>
<th>Trial Type</th>
<th>3-year-olds</th>
<th>5-year-olds</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>$T$</td>
</tr>
<tr>
<td>Training score (max=4)</td>
<td>2.56 (1.03)</td>
<td>2.18*</td>
</tr>
<tr>
<td>Novel explanations (max=4)</td>
<td>2.63 (.89)</td>
<td>2.83*</td>
</tr>
<tr>
<td>Novel labels (max=4)</td>
<td>2.25 (1.0)</td>
<td>3.87</td>
</tr>
<tr>
<td>Explicit judgment (max=3)</td>
<td>1.63 (1.1)</td>
<td>0.46</td>
</tr>
</tbody>
</table>

Note. Mean scores indicate the number of trials on which the children preferred the non-circular explanation (on training trials) or the non-circular informant on the novel labels, novel explanations and explicit judgment tasks. Standard deviations are indicated in parentheses. * $p < .05$, ** $p < .01$, *** $p < .001$

Novel Explanations and Novel Labels. Table 3.4 also displays mean preference for endorsing the informant who had previously provided non-circular explanations and comparisons to 50% chance for the novel explanations and novel labels tasks. As in Study 2, both 3-year-olds and 5-year-olds performed above 50% chance in endorsing the novel explanations from the informant who had provided non-circular explanations. Whereas 5-year-olds performed above 50% chance in endorsing novel labels, 3-year-olds
were unsystematic in endorsing the novel labels provided by either informant. However, these differences in chance-level performance should be interpreted with caution, as a 2 (Age Group: 3-year-olds, 5-year-olds) X 2 (Trial Type: novel explanations, novel labels) repeated-measures ANOVA revealed no significant main effects or interactions.

**Explicit Judgment.** As in Study 2, 5-year-olds were significantly more likely than 3-year-olds to judge the non-circular informant as ‘better’ ($t(30) = 2.07, p < .05, d = 0.34$). Whereas 5-year-olds systematically judged the informant giving non-circular explanations as ‘better’, 3-year-olds were at chance in judging the informants. Note that the findings are similar when exploring the final forced-choice question only.

**Relationship Between Training Trials and Test Trials.** Finally, I assessed the relationship between children’s judgment of explanation quality and their preference for learning from the informant who had provided non-circular explanations. I examined children’s mean test performance (novel explanations + novel labels, max = 8) as a function of the mean number of non-circular explanation choices in the training trials (max = 4), collapsed across Studies 2 and 3. Children displayed a stronger preference for the non-circular informant in the test trials if they had shown more sensitivity toward non-circular explanations during training trials. Inspection of Figure 3.2 indicates that children displayed a stronger preference for the non-circular informant in the test trials if they had shown more sensitivity toward non-circular explanations during training trials. Indeed, almost two thirds of the children tested (40 out of 65) chose the non-circular explanations for at least 3 out of 4 training trials. Of these 40 children, 58% endorsed the informant who had provided non-circular explanations on at least 6 of the 8 test...
questions. By contrast of the 25 children who chose the non-circular informant for less than 3 training trials, only 16% endorsed the informant who had provided non-circular explanations on at least 6 test questions. This difference in test performance by training performance is significant ($\chi^2(1, N = 65) = 10.91, p < .001, \phi = .41$).

*Figure 3.2* Scatter plot of individual children’s preference on test trials (novel explanations and novel labels) as a function of their preference on training trials, across Studies 2 and 3.
To further examine these findings, I conducted a multiple linear regression with total test score as the dependent variable and age in months, training score and experiment as independent variables. The interaction between age and training score and age and experiment were also explored. Age was a significant predictor, (β = 0.35, SE = 0.01, p < .05), accounting for 9% of the variance in test performance. In addition, training performance accounted for 28% of the variation in performance on the test trials (β = 0.79, SE = 0.19, p < .001). No other main effects or interactions were significant. Thus, children’s preference for non-circular explanations during training trials predicted their preference for learning from the non-circular informant during test trials even after controlling for age in months and experiment.

Discussion

Both 3- and 5-year-olds preferred the non-circular explanations during the training trials. Recall that these explanations were shorter than those used in Study 2, suggesting that 3-year-olds’ selective preference for non-circular explanations in Study 3 may be due to the decreased memory load required to make these judgments.

Taken together, the results from Study 3 provide additional support for the findings in Study 2. Both 3- and 5-year-olds monitored the quality of the informants’ explanations, and used those explanations to make inferences about the informants’ future credibility. They endorsed novel explanations provided by the informant who previously used non-circular explanations. However, as in Study 2, only 5-year-olds selectively endorsed this informant in the novel labels task and explicitly judged her as ‘better’, a point that I turn to again in the General Discussion. Moreover, when
collapsing across both experiments, children’s preference for the non-circular explanations in the training phase accounted for unique variance in their subsequent learning from the informant who used non-circular explanations, even after controlling for age.

The findings from Studies 2 and 3 provide compelling evidence to suggest that the quality of explanations informants offer in response to children’s questions matter not only for the acquisition of knowledge, but also for children’s judgments of informants’ credibility. However, these findings are somewhat limited because the sample comprised children from mid- to high-SES families. Given the findings in Study 1 (Chapter 2) of this dissertation, I expect that because children from low-SES backgrounds are exposed to circular explanations more frequently, preschoolers from low-SES backgrounds will show a systematic preference for informants who provide circular explanations. To test this hypothesis, I conducted a follow-up study.

Study 4

Method

Participants. Thirty-two 5-year-old children \( (M = 5; 3; 18 \text{ female}; \text{ range: } 4; 9–6; 2) \). All children were recruited from two local preschools and spoke English as their first language. Half of the children \( (n = 16; \text{ Mage } = 5; 3; \text{ range: } 4; 9–5; 5) \) received school vouchers (low-SES group). The other half of the children \( (n = 16; \text{ Mage } = 5; 7; \text{ range: } 5; 2–6; 2) \) was not eligible to receive school vouchers (mid-SES group). Note, because 3-year-olds’ preferences were fragile at best in Study 3, in the current experiment I chose to only look at 5-year-olds.
**Materials.** The same two informants and 4 pictures were used during training trials that were used in Studies 2 and 3. The entities and explanations used for the training trials, novel explanations and novel labels were identical to those used in Study 3 (shortened explanations).

**Procedure.** All children participated in the same 4 phases as in Studies 2 and 3 (training, novel labels, novel explanations, explicit judgment). The phases were presented in a fixed order, with the exception of the novel label and novel explanation phases which were counterbalanced across children.

**Results**

**Training Trials.** Scores on the Training Trials represent the number of trials (max = 4) on which children endorsed the sentence provided by the non-circular informant. Inspection of Figure 3.3 reveals that mid-SES children showed a significant preference for explanations provided by the non-circular informant during training trials ($M = 3.12$, $SD = 0.72$, $t(15) = 6.26$, $p < .001$, $d = 1.56$). By contrast, Low-SES children displayed a significant preference for sentences provided by the circular informant during training trials ($M = 1.24$, $SD = 1.01$, $t(15) = 3.21$, $p < .05$, $d = .68$).
Figure 3.3. Proportion of trials children chose the non-circular informant by socio-economic background.

**Novel Labels and Novel Explanations Trials.** Mid-SES children selectively preferred to endorse novel labels ($M = 2.75$, $SD = 0.77$, $t(15) = 3.87$, $p < .001$, $d = 0.97$) and novel explanations ($M = 2.62$, $SD = 1.02$, $t(15) = 2.44$, $p < .05$, $d = 0.62$) from the informant who had provided non-circular explanations during training trials. By contrast, low-SES children displayed the opposite pattern: selectively preferring to endorse information from the informant who had previously used circular explanations (novel labels: $M = 1.62$, $SD = 1.02$, $t(15) = 4.39$, $p < .05$, $d = .88$; novel explanations: $M = 1.31$, $SD = 1.19$, $t(15) = 2.725$, $p < .01$, $d = .79$).

To explore the relationship between children’s selectivity on the novel label and the novel explanation task, a repeated-measures ANOVA with trial type (training, novel labels, novel explanations) as the within-subjects variables and SES as the between subjects variable was conducted. This analysis produced a main effect of SES ($F(1,30) = $
37.69, \( p < .001, \eta^2_p = .92 \). No other main effects or interactions were significant. Figure 3.3 displays the proportion of total choices that children directed at the non-circular informant by SES. Inspection of Figure 3.3 indicates that mid-SES children displayed a greater preference for learning novel information from the informant who had previously provided non-circular explanations than low-SES children.

**Explicit judgment.** Mid-SES children designated the non-circular informant as ‘better’ than the circular informant 87.5% of the time. By contrast, only 6% of low-SES children designated her as ‘better.’ To determine if children’s explicit judgment of the relative accuracy of the two informants was related to their preference for the passive informant on novel label, and novel explanations, a repeated-measures ANOVA with trial type (novel label, novel explanations) as a within-subjects variable and explicit judgment (non-circular better, circular better) and SES (mid-SES, low-SES) as between-subjects variables. This analysis yielded a main effect of SES \( (F(1,28) = 4.79, p < .05, \eta^2_p = .15) \). No other main effects or interactions were found.

**Discussion**

When looking at children’s preferences by SES, only mid-SES children demonstrated a systematic preference for learning from the non-circular informant whereas low-SES children showed a strong preference for the circular informant across training trials and test trials. These results support the findings in Study 1 of this dissertation, where I found that caregivers from low-SES families use circular explanations more frequently than non-circular explanations. Arguably, because children from low-SES families are exposed to circular explanations more frequently, and mid-
SES are exposed to non-circular explanations more frequently, one would expect to see differences between mid-SES and low-SES. Indeed, not only did low-SES children show a systematic preference for circular explanations and extend these preferences to future learning scenarios, but they also explicitly judged the circular informant as ‘better.’ These findings have important implications when thinking about how children learn from others, specifically in the classroom context, where non-circular explanations are privileged.

**General Discussion**

Taken together, Studies 2, 3 and 4 support the conclusion that, counter to previous findings (Baum et al., 2008), preschoolers can judge the quality of an explanation by attending to the circularity of the argument. However, what aspects of the explanation children attend to depends on their sociocultural background. Thus, these data extend previous work by showing that children’s evaluation of explanation quality develops over the preschool years and is relatively robust by age 5 (Frazier et al., 2009; Mercier et al., in press).

To the best of my knowledge, no research has explored how children use assessments of explanation quality to judge an informant’s credibility. Instead, previous research has focused on children’s judgments of an informant’s expertise at the single-word level (Sobel & Corriveau, 2010; Koenig & Jaswal, 2011). Across two experiments, I find that both age groups selectively chose the informant who had provided non-circular explanations on a near transfer task (novel explanations). Similarly, 5-year-olds preferred this same informant when learning novel labels. Children’s endorsement of this informant
was also related to their judgment of explanation quality even after controlling for age. Note, these preferences were only found in mid-SES children, indeed when looking at 5-year-old children from low-SES backgrounds in Study 4, a preference for circular explanations was found.

I propose two potential hypotheses to explain these differences. First, as previously mentioned, children from mid-SES families are exposed more to activities that use explanations. Indeed, documented differences have been shown in literacy activities (Payne, Whitehurst & Angell, 1994; Scarborough & Dobrich, 1994). Differences have been shown in how caregivers interact with their children while reading books. Indeed, caregivers from mid-SES families are more likely to use questions as a tool to engage their child with the book which in turn leads to a dialogue that includes explanations (Anderson-Yockel & Haynes, 1994; Haynes & Saunders, 1999). It is plausible that this type of exposure leads children to become more familiar with high-quality explanations and associate them with credibility. Book reading might be an especially powerful mechanism to transmit information about a source’s credibility.

Second, documented differences in patterns of parent talk, indicate that low-SES parents use far more directive speech (e.g., ‘do this,’ ‘go sit down’) than mid-SES parents who have been shown to use far more democratic speech (e.g., ‘where do you think you should be right now?’) (Heath, 1983; Hart & Risley, 1995). Thus, mid-SES patterns of parent talk likely include longer explanations. Mid-SES children may be exposed to these patterns more regularly and thus privilege them in learning situations. These differences are concerning, especially because complex syntactic structures are often used in
academic language, putting low-SES children at a significant disadvantage.

Taken together, preschoolers are surprisingly selective, not only in using single words, but also in using entire utterances to judge an informant’s credibility. Although preschoolers selectively endorsed the claims of the informant who had previously used non-circular explanations, in Studies 2 and 3, only 5-year-olds explicitly judged this informant as ‘better’. For this reason, I chose to only look at 5-year-olds in Study 4. There, mid-SES children explicitly judged the non-circular informant as ‘better’ while the low-SES children judged the circular informant as ‘better.’ This discrepancy in performance between explicit judgment and test performance is in contrast to previous findings demonstrating a relationship between performance on these two tasks (e.g., Koenig, Clement & Harris, 2004). One difference between the setup used in the current set of studies and previous research was that, although the circular explanation was fallacious, it did not have the same degree of blatant inaccuracy as would be seen by an informant mislabeling a shoe a ‘car’. If anything, the difference between a circular and a non-circular explanation might be seen as a difference between an accurate explanation, and a more neutral one. Some previous research has compared children’s selective preference for an accurate labeler over a neutral labeler (who simply states ‘let me take a look at that’; Corriveau, Meints & Harris, 2009). Although 4-year-olds were able to explicitly judge the accurate labeler as ‘better’, 3-year-olds were not, suggesting that 3-year-olds may struggle when explicitly evaluating two informants who display more subtle differences in accuracy. An alternative explanation is that selectivity in explicit judgment questions may require more metacognitive abilities than needed for simple
endorsement. Future research should include both endorse and explicit judgment questions to explore children’s selective learning in these more complex settings.

What is developing in the preschool years in children’s learning from explanations? These data suggest that children’s ability to monitor explanations may display a similar pattern to their monitoring of single-word utterances (e.g., object labels; Jaswal & Neely, 2006; Koenig & Harris, 2005). Whereas older preschoolers (4- and 5-year-olds) use multiple strategies to infer informant credibility (e.g., accuracy and inaccuracy of object labeling), younger preschoolers use more narrow strategies (e.g., inaccuracy only; Pasquini et al., 2007). Similarly, when monitoring for explanation quality, older preschoolers may be more flexible when attending to global strategies (e.g., argument circularity). By contrast, younger preschoolers can use these strategies when selectively learning from informants – but only in certain situations and under certain conditions. Future research should explore the developmental sequence of the cues used for explanation monitoring.

What are the limits of children’s explanation monitoring? On the one hand, children might endorse all claims from an informant providing high-quality explanations. Indeed, research on children’s learning of scientific concepts indicates that young preschoolers blindly accept an informant’s explanations without considering how these claims match with real-world evidence (e.g. Kuhn et al., 2000). An alternative possibility is that children continue to monitor explanation quality even after determining that an informant is credible. Indeed, in some instances, at least a minority of children and adults weight perceptual experience over information from others (Asch, 1956; Corriveau &
Harris, 2010). Future research should examine how children approach novel situations when they have access to both high-quality informants and real-world evidence.

One further question concerns the scope of children’s knowledge about a given domain. In the present experiments, the informants supplied information about scientific phenomena. Given the influence of context on children’s sensitivity to explanations (Kuhn, 2001), it is plausible that children might employ different strategies to evaluate explanations across domains. For example, recent research indicates that adults’ explanations influence how children understand non-observables such as religious phenomena (Canfield & Ganea, 2013; Woolley, Ma & Lopez-Mobilia, 2011).

These findings have important implications for classroom learning. Although I recognize that experimental designs are not always appropriate representations of what occurs in a classroom setting, they provide an important first step in systematically identifying the cues children employ when making decisions about which informants to turn to in learning situations. Indeed, I argue that although it is unlikely that children will be faced with two blatantly different explanations in a classroom setting, it is very likely that they will be exposed to multiple teachers within their classroom, and it is likely that these teachers will provide explanations that vary in quality. Moreover, children are constantly weighing the explanations they hear from their teachers against the explanations they hear from their parents. This could be potentially problematic given the findings of Study 4, where low-SES children prefer circular explanations but the majority of teachers (84%) are white-middle-SES women, and therefore likely to use non-circular explanations (Feistritzer, 2011). As a result, children from low-SES
families might not readily view their teachers as credible sources, making it difficult for them to fully access the curriculum. The type of forced-choice experimental research highlighted here allowed us to isolate the cues children rely on most heavily in learning situations. I examine the implications for classroom learning in more depth in Chapter 6 of this dissertation.

In summary, during the preschool years, children become increasingly sophisticated questioners, thereby prompting a rapidly-expanding exposure to multi-word explanations. This research provides evidence that children are capable of assessing an entire explanation in judging its quality. Perhaps even more compelling, children not only monitor explanations for quality, but they also use this information to make judgments about an informant’s future credibility. Nevertheless, it is still unclear from Study 1 and the current set of Studies if children actually learn from the explanations they hear. I look to explore this question in Study 5 (Chapter 4) of this dissertation.
Chapter 4: What children learn from the explanations they hear: Individual differences in caregivers’ explanations that impact children’s learning

Introduction

Taken together, the results highlighted in chapters 2 and 3 suggest that interaction patterns children use as a tool for learning from others vary across sociocultural contexts. Although children from low-SES and mid-SES groups appear to ask a similar proportion of information-seeking questions, the amount and quality of the explanations they receive from their caregivers vary. It is likely that such variation in caregiver explanations influences how children perceive different sources as learning partners. Some evidence for this conclusion comes from Study 4. Children monitored the quality of explanations to make judgments about the informants’ future credibility. Somewhat surprisingly, children from low-SES families preferred to learn from an informant who used circular explanations (lower quality), whereas children from mid-SES families preferred to learn from an informant who used non-circular explanations. One potential hypothesis for this difference comes from Study 1, where I found that low-SES families provide circular explanations more frequently than non-circular explanations.

In the current study I continue to focus on the role explanations play in children’s learning from others. Here, I examine the second part of the question-explanation-follow-up interaction pattern, focusing specifically on the relationship between explanations and

Figure 4.1. Research model. Study 5 explores the relationship between adults’ explanations and children’s follow-up
children’s follow-up (See Fig 4.1). I focus on one source of individual difference that might influence explanation quality and its relationship to children’s follow-up behaviors (learning): the caregiver’s epistemic stance.

Children experience many different types of conversational environments. Few studies have actually explored the patterns of information children are exposed to when learning from others, and how such patterns are related to the acquisition of conceptual knowledge (Callanan & Valle, 2008; Gelman, 2009). Indeed, to date, the majority of research looking at how children learn from others has focused on the cues they use when deciding from whom to learn (c.f. testimony) (Harris & Koenig, 2006; Heyman 2008; Jaswal, 2010; Koenig & Echols, 2003), with the tacit assumption that such differences in selective learning partners would be related to differences in knowledge acquisition. This study explores how caregivers’ ways of thinking about knowledge, their epistemological stances, influence the types of explanations children hear and their subsequent learning.

There are many domains where explanations provide children with valuable information that children could not otherwise learn through observation or exploration. In particular, the science-domain is rich with concepts that cannot be learned through first hand experiences (e.g., germs, principles of buoyancy etc.). In early childhood, children often approach science learning through social interactions, primarily with parents, teachers, and informal learning partners. Several studies have found that caregivers engage children’s scientific thinking in everyday conversations at museum exhibits by helping children to notice important causal features of the exhibit, providing them with causal explanations and demonstrating how to generate and test a hypothesis (Callanan,
Despite this evidence, it most often the case that parents do not take opportunities to support their children’s scientific exploration with explanations (Gleason & Schauble, 1999; Luce & Callanan, 2011; Shtulman & Checca, 2012), and are likely to vary in the extent to which they use empirical evidence to answer their children’s questions (Sandoval, 2005; Valle, 2009). As a result, children are likely exposed to varying types of explanations that may impact their acquisition of conceptual knowledge. A more sophisticated explanation – one that uses evidence provides children with more information to understand a concept than a less-sophisticated explanation. For example, when talking about the process of snow melting, a caregiver might respond with a less-sophisticated explanation by saying “the sun is hot and heat melts the snow.” By contrast, a caregiver providing an explanation with evidence would likely use examples such as “think about what happens when we take an ice cube out of the freezer or a Popsicle on a hot summer day. Those things are really cold and to stay frozen they need the cold, but when they are in the sun or out of the freezer, they melt because it is not cold anymore.” The latter response provides children with more information that aids in a deeper understanding of the concept. Arguably, children who are presented with an explanation that provides elaborate evidence and examples will have the ability to extend the acquired information to other examples, demonstrating a more complete understanding of the concept. In the current study I explore whether the evidence caregiver’s provide in their explanations is linked to children’s learning of a new concept.

The extent to which caregivers use evidence when talking about scientific
concepts often varies as a function of their education (Evans, Newstead & Byrne, 1993; Valle, 2009) as well as their beliefs about the nature of science (Sandoval, 2005; Valle, 2009). Indeed, Valle (2009) demonstrated that despite science being revered in western cultures, middle-class adults vary in how and the extent to which they engage in scientific thinking. This likely causes children to learn different “ways of reasoning” depending on the family they grow up in. A child who is exposed to more sophisticated reasoning is likely able to reason about events in more sophisticated ways. More sophisticated reasoning often leads to increased conceptual understanding, particularly in the science domain (Mercer & Howe, 2012).

Recent research also suggests that caregivers’ use of evidence when talking about science is linked to epistemological beliefs (Luce, Callanan & Smilovic, 2013; Kuhn, Cheney & Weinstock, 2000; Valle, 2009). According to Kuhn (2001), epistemological beliefs can be divided into four categories: realist, absolutist, multiplist and evaluativist. Kuhn (2001) defines an individual who adopts a realist stance as seeing assertions as copies of an external reality. The explanations they provide are derived from an external source and identical to the sources’ explanation. An individual who adopts an absolutist stance is one who makes assertions that are seen as right or wrong, and are perceived as fixed truth (Kuhn, 2001). For example, seeing science as merely a set of facts or statements such as “People are just born good or evil” implies an absolutist stance. In contrast, a multiplist stance assumes that knowledge comes from humans, and that beliefs are uncertain. Reasoning is seen as an act of weighting multiple perspectives. Indeed, a person who adopts a multiplist stance will likely not use evidence to support one side of
an argument, but rather; perceive both sides of an argument to have some truth. For example, when talking about social issues (e.g. prayer in school, school start-time etc.), *multiplists* will present both sides of the issue and likely find truth in both. Finally, an individual with an *evaluativist* stance perceives knowledge as originating from human minds and therefore as uncertain. Beliefs are constructed based on evidence and judgments are made by testing hypotheses or finding disconfirming evidence (e.g., learning about gravity by dropping a ball). These stances influence the way adults construct knowledge, which alters the responses they provide to their children in learning scenarios. That is, if an individual perceives knowledge as a set of facts and constructs his understanding of the world by viewing facts as absolute truth, then he will likely use facts when responding to his child’s questions. This type of response is restrictive and does not lead children to think critically. Thinking critically about a concept often leads to a more developed understanding of the concept at hand and therefore aids in the acquisition of conceptual knowledge.

To my knowledge, no studies have looked at the direct effects of epistemological stance on adult’s responses to children’s questions and its impact on children’s learning. However, several studies have examined how caregivers’ epistemological stances relate to children’s reasoning and children’s evidence talk. For example, Valle (2009) presented 8 and 11-year-olds and their parents with a series of conflicting scenarios (e.g., Did the Egyptians build the pyramids?). Each scenario consisted of two different claims (e.g., ‘Most historians claim that Egyptians built the pyramids as tombs for their kings’; ‘Other historians claim that most Egyptians did not have the mathematical experience to build
the pyramids’). Parents and children were asked a series of questions to elicit their opinions about the topic. Parent-child conversations were recorded and coded for the use of evidence to support their claims. Results indicated that 98% of highly-educated parents encouraged the use of evidence to support conclusions (Valle, 2009). In addition, the use of evidence was connected to epistemological beliefs. Parents who subscribed to a non-absolutist stance, were more likely to use evidence to support their claims. Although Valle (2009) did not look directly at how caregiver’s evidence talk and epistemic stances were related to children’s reasoning, these findings provide important insight for how children’s conversations with their caregivers might contribute to children’s development of reasoning strategies. These findings have important implications for learning because regular participation in discussions in which critical thinking and the use of evidence to support ideas are encouraged may relate to children’s abilities to acquire conceptual knowledge (Chappell & Overton, 1998).

In a subsequent study Luce, Callanan & Smilovic (2013), looked at the link between parents’ epistemological stances and preschoolers evidence talk. Similar to Valle (2009), Luce et al. (2013), presented children and their caregivers with a book that contained several science-related topics that would likely come up in everyday conversation (e.g., global warming, Pluto no longer being a planet). Each page of the book consisted of a question that related to epistemic stance (e.g., ‘a page on global warming, briefly describing multiple perspectives about global warming and then asking the question “How could someone figure out why the earth is getting warmer?”’). Responses to these questions were recorded and coded for the epistemological stance
they exhibited (e.g., absolutist, multiplist, evaluativist). Utterances were coded as *absolutist* if a parent provided evidence “only for their own position, if one side of the argument was dismissed or easily explained away, or if only one side was explicitly described as correct” (Luce et al., p. 456). An utterance received a *multiplist* code if parents “described both sides of an argument as equally correct, declined to discuss the topic by saying there is no way to tell the answer, or stated that the situation is too complex or uncertain to know” (Luce et al., p. 456). Finally, an *evaluativist* code was assigned when a parent “actively integrated evidence from multiple experts/sources to reach an answer, suggested a way to collect evidence to help decide, or focused on the complexity of the issue while valuing evidence as part of the evaluation” (Luce et al., p. 456). In addition to coding parent-talk, Luce et al. (2013) coded children’s evidence talk in their discussions about angels, germs and mammoths. Both children’s use of evidence and their questions looking for evidence were coded. Results indicated that parents’ expressions of absolutist and evaluativist stances to their children varied depending on the topic under discussion, with more evaluativist talk apparent in science related discussions (e.g., what makes Pluto a planet) than in value-based discussions (e.g., whether it is okay to steal). Indeed, parents’ science backgrounds, as well as the age of the child influenced the stances exhibited by parents, with parents of younger children (4-to 6-year-olds) exhibiting an absolutist stance more frequently (Luce et al., 2013). When looking at the children’s evidence talk and its link to epistemic stance, findings indicated that children’s ability to use evidence and ask questions related to evidence were significantly related to parents’ expressions of an evaluativist stance. Children who
develop the ability to use evidence, develop a more sophisticated way of thinking about concepts (Mercer, Wegerif & Dawes, 1999). This sophisticated thinking is important for problem solving as well as for the acquisition of conceptual knowledge. Indeed, I propose that children who are exposed more to evaluativist stances likely develop more sophisticated ways of thinking and therefore acquire conceptual knowledge more readily.

In the current study I explored individual differences in caregiver’s epistemic beliefs and how these differences impact children’s learning. First I asked whether variations in caregivers’ expressions of epistemological beliefs contributed to the types of explanations caregivers provide their children. Next, I asked whether caregivers’ epistemological beliefs were associated with children’s acquisition of conceptual knowledge. I predicted that caregivers’ epistemological stances would influence the explanations children hear and subsequently children’s learning because as demonstrated by previous research, adults reasoning is often mitigated by epistemological beliefs (e.g., Klaczynski, 2000; Klaczynski, 2001; Stanovich West, 1998; Valle, 2009) and children are often influenced by the epistemological stance of their caregivers (Luce, et al., 2013). Note, because there is a clear dichotomy between evaluativist and absolutist stances, and because parents employ these stances most often when talking to their children about scientific concepts (Luce et al., 2013), the present study will focus only on these two stances. I predict that when caregivers adopt an evaluativist stance, they will provide higher quality explanations and children will learn more from them, then when caregivers adopt an absolutist stance.
Method

Participants. Forty 4- and 5-year-olds and their caregivers were recruited from a local preschool and a local museum (18 female, \( M = 4; 10, SD = 6.3 \) months; range: 4; 0–5; 11). Five additional children were excluded from analyses because of their familiarity with the toy.

At the museum, research assistants stood in the discovery center and informed families that they were collecting data for a research project in collaboration with the National Living Laboratory and invited to participate in the study. At the preschool, the director e-mailed parents to advertise the study. Before beginning the study, parents at both the museum and the preschool were given details about the protocol and asked to sign an informed consent to participate as well as to be videotaped. As a thank you, the preschool classrooms were given three sets of the science toy used in the study. No compensation was given to museum participants. All children were English speaking and came from white-middle-class families. I chose to look at children from white-middle-class families because of the results from the studies in Chapters 1 and 2 which demonstrated that the question, explanation, follow-up pattern of interaction for learning might not be privileged by all children; in the current study I focus on the one group in which this pattern of interaction is clearly privileged: mid- and high- SES families.

Materials. Children and their caregivers sat at a small table located in the corner of a quiet room. In the museum, the table was located at the back right corner of the children’s discovery center. At the preschool, parents and children sat at a table located in a small classroom. A video camera was strategically placed on a tripod so that caregiver-
child interactions could be seen and heard, but so that the video camera did not distract the child. During all three phases children and their caregivers played with a snap circuit toy. Snap circuit is a toy produced by Elenco© that consists of 32 electrical components that children assemble on a plastic module to create electric circuits. In the exploration phase 7 of the components were used: a battery pack, a lever switch, a fan and 4 snaps. The toy consists of 20 snaps that vary in size. For the exploration phase 2 small snaps (marked 2), 1 large snap (marked 5) and 1 medium snap (marked 3) were used. For the learning phase children were presented with 7 identical pieces that were used in the exploration phase. In the novel extension phase, 7 novel pieces were used: a small light bulb, a button switch, a battery pack and 4 snaps. The four snaps were different sizes than the ones used in the exploration and learning phase. They consisted of 2 medium snaps (marked 3), 1 larger snap (marked 4) and a small snap (marked 2).

**Pilot data.** To ensure that this toy was appropriate for use with children in this age range, the toy was piloted at the museum with 16 typically developing 4-year-olds. A research assistant presented children with the toy and provided them with a scripted explanation of how the toy works while systematically modeling how to assemble the toy. Children were then given the pieces of the toy and asked to assemble it on their own. Fifteen of the 16 children tested (93.75%) successfully completed the toy on their own. The average time it took to assemble the toy was 2 minutes and 47 seconds. These data informed the experimental phases, where children were given 3 minutes to assemble the toy on their own before an experimenter provided assistance.
**Procedure.** Children and caregivers participated in 3 phases: (a) exploration phase (b) learning phase and (c) novel extension phase. Following the exploration phase, caregiver’s were asked four pointed questions that were used to measure the caregiver’s epistemological stance. These same four pointed questions were asked to children following the novel extension phase. All phases were presented in a fixed order.

*Exploration phase.* Caregivers and children were presented with a pre-assembled snap circuit toy and told “Here is a fun toy for you to play with. You can take the pieces apart and put them together again” (the experimenter demonstrated how the snaps can be taken off and put back on). The toy was pre-assembled to provide caregivers with a model of what the toy looked like when it was put together correctly. After introducing the toy, the experimenter removed all 7 pieces from the module and say “Now it is your turn to play with the toy. Can you and your [mom] work together to put the pieces together to make the fan turn on.” Caregivers and children were given five minutes to explore the toy. All interactions were video recorded.

*Learning Phase.* Immediately following the exploration phase, caregivers were asked to remove themselves from the table and told that the experimenters were interested in seeing what the child did with the toy on his or her own. They were also told that if after 3 minutes the child did not assemble the toy, the experimenter would help the child. Next, the experimenter told the child “Now it is time to play with the toy all by yourself.” The experimenter placed the plastic module in front of the child as well as a battery pack, a switch, a fan, and 4 snaps (the same 7 pieces used during the exploration phase) and prompted the child “Can you put this toy together all by yourself, and make
the fan turn on?” Because I am interested in if children learned from the explanations provided to them by caregivers during the exploration phase, the experimenter reminded caregivers not to help their children. Children’s actions were video recorded and successful completion of the task was noted. Additionally, the time it took to complete the task and the number of pieces the child successfully placed at the end of 3 minutes were recorded.

**Novel Extension Phase.** Finally, in the novel extension phase, children were presented with a third snap circuit toy. Recall, this snap circuit contained 4 different snaps, a battery pack, a button switch and a light bulb (instead of a fan). Children were prompted by the experimenter “I have one more toy for you to play with. But look, there is a light bulb. Can you put the toy together to make the light bulb turn on?” Caregivers were reminded not to provide any assistance, and that if after 3-minutes the child had not successfully completed the toy, the experimenter helped the child. Again, children’s actions were video recorded and successful completion of the task as well as the number of correctly placed pieces were noted.

**Caregiver’s Epistemological Beliefs.** To ensure that all children were exposed to explanations and to measure caregiver’s epistemological beliefs, 4 pointed questions were asked following the learning task. These questions were designed to resemble questions that children would likely ask their caregivers about the toy. Questions included: 1) What would happen if we took this snap off? (the experimenter points to a snap) 2) Why is there a battery? 3) How does the switch work? 4) What would happen if we put on another snap? (the experimenter hands the caregiver a new snap). Responses
given to these questions were coded using a similar coding scheme used by Luce et al. (2013). I discuss the coding scheme in more detail later in this section.

*Children’s explicit questions.* Following the novel extension phase, children were asked the same 4 questions that caregivers were asked following the exploration phase. These questions were asked approximately 6 minutes after caregivers provided their responses to the same questions. We were interested in seeing if children provided similar responses to their caregivers and how their responses were related to their acquisition of conceptual knowledge.

**Coding.** Initially I planned to use the same coding scheme that was applied in Study 1. However, because few children actually asked questions during the 5 minute exploration phase (30 of 40 children, 75% did not ask any questions) opportunities for adult explanations children’s follow-up were limited. Therefore a new coding scheme was developed.

*Epistemological beliefs.* Using a coding scheme modified from Luce et al. (2013), a research assistant and I coded caregiver’s expressions of epistemological stances in their responses to the 4 explicit questions. Examples for each category (absolutist and evaluativist) are provided in Table 4.1. For each question we assigned only one code that represented the epistemological stance that was conveyed by the caregiver’s response (evaluativist or absolutist). A score of “0” was assigned to absolutist stances, while “1” was assigned to evaluativist stances. A composite score was created for each participant (max score= 4). Thus, the two categories listed below were treated as mutually exclusive. Inter-rater reliability was established on all 40 participants with 90% agreement (Cohen’s
kappa = .87).

**Absolutist.** The absolutist code was assigned if a caregiver provided an assertion that was a statement of facts, or an explanation that presented evidence as if it were a fixed truth and no other possible explanations could exist.

**Evaluativist.** The evaluativist code was assigned if a caregiver actively provided evidence using multiple examples/sources, proposed a hypothesis and suggested a way to collect evidence.

Table 4.1. Examples of caregivers’ responses to explicit questions by epistemological stance

<table>
<thead>
<tr>
<th>Question</th>
<th>Absolutist Response</th>
<th>Evaluativist Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>What would happen if we took this snap off? (P# 5)</td>
<td>“It wouldn’t work”</td>
<td>“Well the battery isn’t connected to both sides of the fan anymore and it needs to be connected to both ends right? That way it makes a whole loop that brings the power from the battery to the fan and back to the battery.”</td>
</tr>
<tr>
<td>Why is there a battery? (P# 32)</td>
<td>“It gives it power to make it work.”</td>
<td>“The battery gives the fan power and fans need power to work. It is like your toy car at home, in order for it to work we need to put in batteries because they give the car power.”</td>
</tr>
<tr>
<td>How does the switch work? (P# 16)</td>
<td>“You turn it on and off. When it is on the fan moves, when it is off the fan doesn’t move.”</td>
<td>“The switch is like a pipe. If there is a hole in the pipe then the water leaks out. When the switch is off it makes a hole like a pipe and the power leaks out and cannot get to the fan. When the switch is on the hole is closed and the power can get through and make the fan work.”</td>
</tr>
<tr>
<td>What would happen if we added this snap? (P# 20)</td>
<td>“It will still work.”</td>
<td>“We add another snap…maybe it would take off and start flying…it would pick up the speed? Can we try it? Do you want to see if it picks up the speed? Let’s see if it goes faster. Can it go any faster? It’s hard to tell, but it feels like there is more wind which means it is moving faster.”</td>
</tr>
</tbody>
</table>
Children’s learning. In addition to coding children’s behavior (completion of tasks, time to complete talks and number of pieces appropriately placed), I coded children’s responses to the explicit questions they were asked after completing the novel extension task. Despite my initial plans to look at children’s epistemological stances, there was little variability in the types of responses children offered. Indeed, only 1 child provided responses indicative of an evaluativist stance. These data resembled the evidence talk of 4- and 5-year-olds in Luce et al.’s (2013) study, where children were more likely to provide responses that exhibited an absolutist stance. This is likely because 4-and 5-year-olds have not yet developed the skills to construct more complex explanations that are often synonymous with evaluativist stances.

As an alternative coding scheme, I coded children’s learning by noting whether or not children provided a correct response to the pointed questions. Given that these questions were asked approximately 6 minutes after caregivers’ questions, children’s responses were more likely related to their conceptual understanding rather than simply repeating what their caregiver had said. Incorrect responses were coded as “0,” and correct responses were coded as “1.” For examples see Table 4.2. A composite score was calculated for each child (max score= 4).
Table 4.2. Examples of children’s responses to explicit questions

<table>
<thead>
<tr>
<th>Question</th>
<th>Incorrect Response</th>
<th>Correct Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>“What would happen if you took of this snap?”</td>
<td>“Nothing, it still works” P# 5</td>
<td>“It won’t work” P# 16</td>
</tr>
<tr>
<td>“Why is there a battery?”</td>
<td>“So the batteries won’t work” P# 6</td>
<td>“To give it power to make it work” P# 17</td>
</tr>
<tr>
<td>“How does the switch work?”</td>
<td>“I don’t know” P# 7</td>
<td>“You move it like this to turn it on and off” P# 25</td>
</tr>
<tr>
<td>“What would happen if we added this snap?”</td>
<td>“It makes it bigger” P# 19</td>
<td>“It turns off” P# 37</td>
</tr>
</tbody>
</table>

Caregiver’s Occupation. As another individual difference measure I asked caregivers to provide their occupations. Previous research suggests that caregiver’s with science backgrounds tend to adopt evaluativist stances when talking about science (Luce et al., 2013; Valle 2009), therefore I wanted to control for this in analyses. Science related occupations (e.g., engineer, chemist etc.) were coded as “1”, while non-science occupations (e.g., social worker, lawyer, stay at home mom) were coded as “0.” Eight of the 40 caregiver’s (20%) reported working in a science related field.

Results

Caregivers’ Epistemological Stance. For each of the four explicit questions, caregivers’ explanations were assigned one stance that best captured their response. A composite score of all 4 questions was then created. Higher scores (3 or 4) were labeled as evaluativist, while caregivers with low scores (0 or 1) were labeled as absolutist. Twenty caregivers (55%) were coded as conveying an absolutist stance, while 16 caregivers (44%) were coded as conveying an absolutist stance. Four caregivers scored a “2” which was neither marked as absolutist nor evaluativist. These four caregivers were
excluded from some of the analyses below.

**Links between Caregiver’s Epistemological Stances and Children’s Learning.** To explore the association between caregivers’ epistemic stances and children’s learning, I began by looking at children’s learning behaviors. I first explored their behaviors in the learning phase and novel extension phase, before turning to their overall performance.

**Learning Phase.** I first explored children’s performance in the learning phase. Eighteen out of 40 children successfully completed the task (42.9%), whereas 22 children did not (52.4%). Recall, successful completion was coded if all 7 pieces were appropriately placed. On average, it took children who completed the task 167.7s ($SD = 85s$). When looking at the number of pieces correctly placed, on average children placed 4.78 pieces ($SD = 2.56$ pieces). To explore children’s performance in the learning phase, a logistic regression was conducted with task completion as the dependent variable and age (months) as the predictor variable. Children’s age did not significantly predict successful completion of the learning task $\chi^2 (1) = 1.71$, $p = .19$. $\beta = .07$, $t (39) = 1.64$, $n.s.$

Next, I explored the relationship between caregiver’s epistemic stances and children’s performance on the learning task. To determine if caregivers’ epistemic stances predicted children’s completion of the task, I conducted a logistic regression with caregivers’ epistemic composite scores as the predictor variable and children’s completion of the task (“yes” or “no”) as the dependent variable. Caregivers’ epistemic stances did not significantly predict children’s completion of the learning task, $\chi^2 (1) =$
Recall that in addition to measuring children’s completion of the task, I also measured the number of pieces children correctly placed at the end of the allotted 3 minutes. Indeed, there were many instances where children did not successfully complete the task, but successfully placed the majority of the pieces (5 or more pieces), indicating an emerging understanding of how the toy worked. To explore these subtle differences and the extent to which caregiver’s epistemic stance was associated with the number of pieces children placed, a simple linear regression using caregivers’ epistemic stance composite scores (max=4) as the predictor variable and number of pieces placed in the learning phase (max=7) as the dependent variable was conducted. As was the case when looking at successful completion of the task, the overall model of caregiver’s epistemic stance trended towards significance $F(1, 38) = 3.24, p = .08, R^2 = 0.08$.

**Novel Extension Phase.** Subsequently, I explored children’s performance on the novel extension phase. Given that this phase was different from the exploration and learning phase, I predicted that fewer children would successfully complete the task. Somewhat surprisingly, a similar proportion of children successfully completed the task as in the learning phase (42.9%), 52.4% did not complete the task. However, it took significantly longer for children to complete the novel extension phase ($M = 213.4, SD = 88.13$), compared to the learning phase ($M = 167.6, SD = 85.6$) $t(39) = 3.34, p < .05, d = 0.52$. When looking at average number of pieces that were appropriately placed, only 4.37 pieces were placed ($SD = 2.7$). This was not significantly different than the number of pieces placed during the learning phase. To explore children’s performance in the
novel extension phase, a logistic regression was conducted with task completion as the dependent variable and age (months) as the predictor variable. Children’s age trended towards, but did not significantly predict successful completion of the learning task $\chi^2 (1) = 2.99, p = .08$. $\beta = .09, t (39) = 2.77, n.s.$

Next, a logistic regression was performed to ascertain the effects of caregiver’s epistemic stance on the likelihood that participants completed the novel extension phase. The logistic regression model was statistically significant, $\chi^2 (1) = 5.78, p < .05$. The model explained 13.5% (Nagelkerke $R^2$) of the variance in children’s completion of the novel extension task. Caregivers’ epistemic stances were associated with an increased likelihood of completing the task.

In addition to exploring completion of the task, I examined the relationship between caregiver’s epistemic stance and the number of pieces children correctly placed. As was the case with the learning phase, there were many instances where children did not successfully complete the task, but successfully placed the majority of the pieces (5 or more pieces), indicating an emerging understanding of how the toy worked. A simple linear regression was conducted using epistemic stance composite scores (max =4) as the predictor variable and number of pieces placed in the novel extension phase (max=7) as the dependent variable. The overall fit of the model was statistically significant, $F (1, 38) = 9.73, p < .01$, $R^2 = 0.20$ and epistemic stance significantly predicted the number of pieces children successfully placed in the novel extension phase ($\beta = .45, t (38) = 3.1, p < .01$). Indeed, as caregivers’ epistemic stance composite scores increased, (indicating an evaluativist perspective) children successfully placed more pieces.

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Overall Learning. To test the link between caregivers’ epistemological stances and children’s learning I ran a multiple linear regression, using children’s total pieces (number of pieces assembled during the learning phase + number of pieces assembled during the novel extension phase) as the dependent variable and composite epistemic stance score and caregiver’s occupation as predictor variables. Together, the overall model of caregivers’ epistemological stance and caregivers’ occupation significantly predicted the number of pieces children successfully placed (max score =14) $F(2, 37) = 3.93, p < .05, R^2 = 0.18$. When holding caregivers’ occupation constant (scientists vs. non-scientists), caregivers’ epistemic stances significantly predicted the number of pieces children successfully placed, ($\beta = .44, t(39) = 2.8, p < .01$) suggesting that irrespective of a caregiver’s occupation, epistemological stances was associated with children’s overall learning.

Note, that although I chose to treat epistemic stance as a continuous variable in order to capture more of the subtle differences, I could have also looked at these data by binning caregivers by epistemic stance (absolutist and evaluativist) and comparing children’s performance between the two groups$^1$. First, when looking at children’s performance on the learning phase, children of caregivers who exhibited an absolutist stance successfully placed fewer pieces ($M = 3.9, SD = 2.5$) than children of caregivers who exhibited an evaluativist stance ($M = 5.7, SD = 2.4$). The difference was significant $t(34) = -2.25, p < .05, d = -0.73$ (See Fig X.). A similar pattern was found when looking at performance on the novel extension phase (absolutist caregiver: $M = 3.2, SD = 2.7$; non-absolutist caregiver: $M = 6.1, SD = 2.9$).

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$^1$ Recall 4 caregivers were removed from these analyses because they received a score of “2” which was neither absolutist nor evaluativist.
When looking at children’s overall learning, an independent samples t-test revealed significant differences in the number of pieces children successfully placed. On average, children of caregivers who exhibited an absolutist stance successfully placed fewer pieces ($M = 7.1$, $SD = 5$) than children of caregivers who exhibited an evaluativist stance ($M = 11.6$, $SD = 4.1$). This difference was significant $t (34) = -2.87$, $p < .05$, $d = -0.98$ (See Fig. 4.2). These findings further confirm that differences do exist in children’s learning based on the epistemic stance of their caregivers and its influence on the explanations they provide their children.

**Figure 4.2.** Proportion of pieces children correctly placed by task by caregivers’ epistemological stance

*Children’s Explicit Questions.* In addition to looking at behavioral follow-up, I also looked at verbal follow-up by exploring the answers to the follow-up questions. I hypothesized that children who heard explanations provided by a caregiver who adopted
a more evaluativist stance would provide correct answers to the explicit questions that followed the novel extension phase more frequently. To test this hypothesis, I conducted a linear regression with child’s response total (max = 4) as the dependent variable and caregiver’s composite epistemic stance score as the predictor variable. The overall fit of the model was significant $F(1, 38) = 7.55, p < .01, R^2 = 0.17$, and caregiver’s epistemic stance significantly predicted children’s responses to the pointed questions, $\beta = .41, t(39) = 2.7, p < .01$.

When looking at these data by binning caregivers by epistemic stance, a similar pattern emerged. On average, children of caregivers who exhibited an absolutist stance provided fewer correct responses ($M = 1.75, SD = 1.25$) than children of caregivers who exhibited an evaluativist stance ($M = 2.7, SD = 0.9$). This difference was significant $t(34) = -2.48, p < .05, d = -0.87$ (See Fig. 4.3). To confirm that children were not simply repeating exactly what their caregiver said, I looked at the percent of questions in which children provided an identical response to their caregivers. Only 1 case was found where a child repeated the answers to all four questions using the same responses as his caregiver.
Discussion

Taken together, the results of Study 4 support 3 main conclusions. First, the quality of parent explanations varied widely, and varied based on parental epistemological stance. Second, parental epistemological stance was related to differences in child-level behavior, both on a learning task, and on a novel extension task. Finally, parental epistemological stance was related to differences in child-level verbal responses. Children were more likely to respond to follow-up questions correctly if they had received evaluativist explanations. I discuss each of these conclusions below, before turning to how these findings are related to children’s selective learning from others.

First, I found significant variability in the quality of the explanations provided by caregivers. Indeed, inspection of the interaction during the learning phase revealed that

*Figure 4.3. Number of children’s correct responses to explicit questions by caregivers’ epistemic stance*
only 8 caregivers provided explanations to their children, 3 of these caregivers provided spontaneous explanations, while 5 of them provided explanations in responses to their children’s questions. These data are similar to findings by Shtulman and Checca (2012) who found that caregivers even when presented with the opportunity to provide explanations about science, caregivers do not almost 80% of the time. Because of how few caregivers offered explanations, I did not consider these in analyses. Instead, I looked at caregivers responses to explicit questions to measure the variability in explanation quality. When looking at caregivers’ responses to explicit questions, many caregivers used evidence to support their claims, while others simply provided fact-based assertions. The claims that included evidence were often longer and more sophisticated than those that did not, suggesting that the use of evidence and examples is important to providing children with the information they need to acquire conceptual knowledge.

Second, these data provide compelling evidence to suggest that children do use the explanations they hear to acquire conceptual knowledge. The content of these explanations was influenced by caregivers’ epistemological beliefs. Children of caregivers who adopted an evaluativist stance learned more than children of caregivers who adopted an absolutist stance. Indeed, caregivers’ epistemic stance significantly predicted children’s overall performance (how many pieces children correctly placed), even after controlling for caregivers occupation. Children of caregivers who adopted an evaluativist stance successfully placed more pieces than children of caregivers who adopted an absolutist stance, suggesting that they had developed a more sophisticated understanding of how circuits work.
Third, not only did children physically display their understanding of the concept, but when asked explicit questions about how circuits work, caregivers’ epistemic stances were also associated with children’s responses. Children of caregivers who adopted an evaluativist stance provided correct answers more often than children of caregivers who adopted an evaluativist stance. The ability to verbalize their understanding of how circuits work, demonstrates the use of a complex set of cognitive processes that are only beginning to emerge around age 4 (Kuhn & Katz, 2009). It is around this age that children begin to produce their own explanations (Legare, Wellman & Gelman, 2010; Rittle-Johnson, Saylor, & Swygert, 2008). Note, although these questions were identical to the ones that parents heard, approximately 6 minutes elapsed before children were asked the questions. Given this time lapse, it is unlikely that children’s responses were simply an imitation of what their caregiver’s said. Indeed, when measuring the epistemic stance exhibited by the responses provided by children, no variability was found. If children were imitating their parents, then one would expect children of parents who exhibited an evaluativist stance to convey a similar stance in their responses, however this was not the case.

One might contend that children’s performance was simply due to exposure in the exploration phase. However, when looking at the learning phase and novel extension phase separately, more of the variability in children’s performance could be explained by the novel extension phase. This is important to highlight, because unlike in the learning phase, where children repeated the task from the exploration phase, in the novel extension phase children could not simply imitate what they had previously seen. Instead,
children were required to extend their understanding of how circuits work to successfully complete the task.

Why do children appear to learn more from caregivers who exhibit an evaluativist stance? Two explanations seem feasible. As suggested by Luce et al. (2013) caregiver’s reasoning about evidence is linked to how children reason about evidence. Although this pattern was only found in older children, it is possible that children’s reasoning skills are developing at younger ages and being informed by their caregiver’s epistemological beliefs. Thus, exposure to more complex reasoning may lead children to more sophisticated types of reasoning that aid in their acquisition of conceptual knowledge. A second plausible explanation for why caregivers’ epistemological beliefs may predict children’s learning is the overall length and content of the explanations provided by these caregivers. On average, caregivers with evaluativist stances provide longer explanations, often including more content that children might need to help them acquire a concept. These caregivers frequently provide evidence from familiar experiences, so children can easily situate the content of the explanation. Additionally, longer responses also suggest that the caregiver is spending more time engaging with their child about the concept, giving the child an opportunity to think more deeply about the concept. Likewise, caregivers’ responses might be influenced by the joint knowledge they think they have with their children. Because the current study focused on naturalistic interactions, the length of explanations was not controlled for. Therefore, in future studies it will be important to consider how the length of the explanation contributes to children’s acquisition of conceptual knowledge.
One limitation of these findings is that they are somewhat limited to the science domain. The task used to explore children’s conceptual knowledge was a science task. Therefore, caregivers’ responses were likely constrained to one of two categories (absolutist vs. evaluativist). In future work it will be important to consider the breadth of epistemological categories and how they contribute to children’s acquisition of conceptual knowledge across domains.

Despite these limitations, the findings from this study have important implications for school readiness. The previous studies presented in this dissertation highlighted significant differences in how children learn from others across socioeconomic groups. Here, I highlight within group differences. Indeed, it is not always the case that children from mid-SES families learn from the explanations they hear. The extent to which children learn is predicted by the epistemic stance of the informant. Therefore, there may be a discrepancy in children’s understanding of specific concepts by the time they reach formal schooling. Teachers should be aware of this discrepancy and adopt an evaluativist stance (whenever possible) when providing children with explanations to aid in the acquisition of conceptual knowledge.
Chapter 5: General Discussion

Children rely on many different strategies when learning about the world. Some of these strategies are more effective than others. For instance, when learning about unobservable referents, it is more effective for children to seek information from another individual than trying to learn through first-hand observation or exploration. There are many different patterns of interaction children engage in to acquire this information. In Chapter 1, I highlighted three aspects of an interaction pattern that is often privileged in formal schooling: children’s questions, caregiver responses to children’s questions and children’s follow-up. I proposed two factors that might influence this pattern: socioeconomic status and caregivers’ epistemological stances. The goal of this dissertation was to explore how children use the question, explanation, follow-up pattern of discourse as a mechanism for learning from others and potential individual differences that might change how this pattern is used for learning. Given the documented differences in patterns of parent talk, I proposed that this pattern would be influenced by families’ socioeconomic status and caregivers’ epistemological stances. Chapter 2 (Study 1) explored the entire question, explanation, follow-up pattern across children from diverse socioeconomic backgrounds. In Chapter 3 (Studies 2, 3 & 4), I explored the relationship between children’s questions and the explanations they hear. Specifically, I focused on how children use explanation quality as a tool to make judgments about an informant’s credibility. I explored how children across diverse backgrounds might judge explanation quality differently, thereby impacting their judgments about an informant. Finally, in Chapter 4 (Study 5) I explored the relationship between caregivers’
explanations and children’s behavioral follow-up. Here I focused on individual differences in caregivers’ epistemological stances and how these differences contribute to children’s learning.

Chapter 2 (Study 1) presented, to my knowledge, the first study that explored the question, explanation, follow-up pattern of interaction across diverse backgrounds. Based on the work by Frazier, Welman and Gellman (2009), there was reason to believe that children’s follow-up might be different in children from diverse racial groups. Indeed, Frazier, Welman and Gelman (2009) recognized that a major limitation of their study was that children all came from white-mid/high-SES families and previous research on patterns of talk reveals differences in this group compared to low-SES families (Tizard & Hughes, 1984; Hart & Risley, 1992). The Study presented in Chapter 2 was designed to explore potential differences in this interaction pattern as a mechanism for learning from others.

In Study 1 (Chapter 2), I applied a 3-part coding scheme to 37 transcripts taken from the CHILDES database (Mcwhinney & Snow, 2000). When looking at the types of questions children asked, both mid-SES and low-SES children asked a similar proportion of information seeking questions. Information-seeking questions included fact-based questions and causal questions. In contrast, when looking at caregiver’s responses, significant differences were found between mid-SES and low-SES families. In particular, when looking at responses to causal questions, mid-SES caregivers provided significantly more exemplary responses (responses that included explanations) compared to low-SES caregivers and when looking at responses that included explanations in general mid-SES
caregivers provided more non-circular explanations (high-quality) whereas low-SES caregivers provided more circular explanations. Thus, not only do the types of responses children receive vary, but the quality of these responses varies as well. Of course, these differences may be due to the knowledge base of the caregiver that is needed to provide high-quality explanations and therefore, these differences might not exist if children asked more questions in a domain the caregiver is comfortable with.

Study 1 (Chapter 2) also revealed significant differences in children’s follow-up. Although children’s follow-up to adult responses to their fact-based questions was consistent across low-SES and mid-SES groups, children’s reactions to caregivers’ responses to causal questions varied. Mid-SES children provided their own explanations more frequently than low-SES children when they received unsatisfactory responses. This finding was consistent with Frazier, Gelman and Welman’s (2009) work exploring children’s follow-up. Moreover, both mid-SES and low-SES caregivers repeated their original question a similar proportion of times when receiving unsatisfactory responses. As previously noted, this response indicates that children are not simply trying to extend their conversation with adults, but actively seeking the information needed to answer their question. These findings highlight important differences in the overall pattern of interaction children use when learning from others. The main differences in this interaction pattern centered on caregivers’ explanations. Therefore, in Chapters 3 and 4, I highlighted two different parts of the interaction pattern that included caregivers’ explanations.

In Chapter 3 (Studies 2, 3 & 4) I investigated the explanations caregivers provide
to questions and how these explanations are evaluated by children to make judgments about the informants’ credibility (c.f., testimony). Although no work to my knowledge has considered cues children use when evaluating explanations to learn from others, many studies have explored the cues children use when monitoring single words to make judgments about an informant decades (for reviews see Harris, 2012; Sobel & Kushnir, 2013; Gelman, 2009). To explore children’s selective trust, experimenters have employed the selective trust paradigm (e.g., Corriveau & Harris 2009a; Harris, 2012; Koenig, 2012; Koenig & Woodward, 2010). Across three studies I used the selective trust paradigm to investigate how children monitor explanations to make judgments about an informant. In the first study (Study 2 of this dissertation), children were presented with two different informants who provided two different explanations to a question. One explanation was always circular (low-quality), while the other explanation was always non-circular (high-quality). Whereas 5-year-olds demonstrated a selective preference for non-circular over circular explanations, 3-year-olds did not. In two subsequent phases (novel labels and novel explanations) 5-year-olds evaluations of explanations extended to their inferences about the informants’ future credibility and they systematically preferred learning from the informant who had previously provided non-circular explanations. Somewhat surprisingly, 3-year-olds also showed a selective preference for learning from informants who had previously provided non-circular informants during the novel explanations phase.

To explore why 3-year-olds showed a preference for learning from non-circular informants, but not a preference for non-circular explanations, a follow up study was
conducted. When the explanations were shortened in Study 3, both 3- and 5-year-olds demonstrated a preference for non-circular explanations and extended this preference when deciding from whom to learn in the novel explanations task. As in Study 2, only 5-year-olds showed a systematic preference for learning novel labels from the non-circular informant. I argued that this was likely because the novel explanations task was more closely related to the training trials where informants provided explanations about familiar entities.

Given the results from Study 1 (Chapter 2) I had reason to believe that if children use explanations to make judgments about an informant’s credibility, then individual differences would exist in what children from diverse socioeconomic backgrounds attend to. Specifically, I predicted that children would prefer circular explanations because that is what they were most frequently exposed to. Indeed, Study 4 confirmed this hypothesis and children from low-SES families systematically preferred circular explanations and extended this preference when deciding from whom to learn. In contrast, mid-SES children selectively preferred non-circular explanations and preferred to learn from an informant who had previously provided a non-circular explanation. Future studies may consider looking at other cues children attend to when monitoring caregiver’s responses to their questions and how this influences their perceptions of an informant as a credible source for learning.

In Chapter 4 (Study 5), I explored the second half of the interaction pattern: caregivers’ explanations and children’s follow-up. I looked at whether children actually learned from the explanations they heard and individual differences that may have
influenced caregivers’ explanations and children’s subsequent learning. I focused on the epistemological beliefs of the caregiver, because as previous research suggests, these beliefs influence caregivers’ explanations (Luce et al., 2013; Valle 2009). In the first phase, caregivers and their children played with a novel toy (snap circuits) and caregivers were asked four explicit questions. Forty-four percent of caregivers adopted an evaluativist stance when answering these questions, while the remaining 55% adopted an absolutist stance. Children’s performance on subsequent learning tasks was impacted by their caregiver’s epistemological beliefs. Children of caregivers who adopted an evaluativist stance learned more than children of caregivers who adopted an absolutist stance. Caregivers’ epistemic stance significantly predicted children’s overall performance (how many pieces children correctly placed), even after controlling for caregivers occupation. Children of caregivers who adopted an evaluativist stance successfully placed more pieces than children of caregivers who adopted an absolutist stance, suggesting that they had developed a more sophisticated understanding of how circuits work.

Taken together the results from Chapters 2, 3 and 4 indicate that the question, explanation, follow-up pattern of interaction may not be a universal mechanism used by children when learning from others. In this chapter I attempt to explain why these differences exist and how they contribute to cognitive differences in children from low-SES and mid-SES families.

In Chapter 1, I highlighted two individual differences that may contribute to variability in the question, explanation, follow-up pattern of interaction: socioeconomic
status and caregivers’ epistemological stances. A large number of studies have documented differences in patterns of caregiver talk across diverse backgrounds. From the complexity and amount of language caregivers’ use, to the directedness of their speech, it is well established that socioeconomic status contributes to differences in the linguistic nature of a child’s environment (Tizard & Hughes, 1983; Tizard & Hughes, 1984; Hart & Risley, 1992; Hart & Riseley, 1995; Robinson & Rackstraw, 1967). In Chapter 2 of the current dissertation I extended these findings to demonstrate that differences also exist in the types and quality of responses caregivers use to respond to their children’s questions. Although one plausible explanation for these differences is due to the cultural differences in patterns of speech, it is also possible that the quality of responses might be due to differences in knowledge. Caregivers from low-SES families provided more circular explanations. Recall these explanations reiterate children’s questions and therefore no new information is provided. It is probable that caregivers from low-SES families simply do not have the knowledge needed to provide non-circular explanations. This difference in exposure to explanations is linked to how children perceive informants. As seen in Chapter 3 (Studies 2, 3 & 4), children use explanation quality to make judgments about an informant’s credibility. Mid-SES children prefer caregivers who use non-circular explanations, whereas children from low-SES families prefer informants who use circular explanations. Hence, the findings from Chapters 2 and 3 reveal that not only are there differences in patterns of discourse used by children across socioeconomic backgrounds, but these differences are linked to how children perceive informants. Stated more broadly and provocatively, it is possible that children
from low-SES families might not view teachers who use non-circular explanations as credible and therefore not turn to these types of teachers in learning situations.

Indeed, explanations not only provide children with the opportunity to engage in a linguistically rich discourse, but the results from Study 5 (Chapter 4) show that children do learn from the explanations they hear. The extent to which children learn is influenced by caregivers’ epistemological beliefs. When children are presented with explanations that use evidence and examples, they learn more. It is not surprising that children learn from the explanations they hear given the results from Study 1 (Chapter 2) which show children follow-up when they receive an unsatisfactory response. For instance, when looking at follow-up to causal questions, children follow-up when they did not receive an explanation. These data suggest that children seek specific types of responses to the questions they ask in order to acquire new information.

What do these findings mean for child development? Broadly speaking, children use a range of interactions when learning from others. Certain interaction patterns are more ideal for acquiring conceptual knowledge than others. In the current set of studies I demonstrated that one tool children use to acquire conceptual knowledge is questions. Children’s conceptual knowledge develops during the preschool years (Spelke & Carey, 1994) Conceptual knowledge is characterized most clearly as knowledge that is rich in relationships. It can be thought of as an interconnected web of knowledge in which the linking relationships are as important as the discrete pieces of information (Hiebert & Lefevre, 1986). The development of conceptual knowledge parallels the development of children’s questions. Beginning with ‘what’ questions which yield information that
provides children with discrete information and then moving to ‘why’ questions, which provide children with causal connections, one would expect to see a shift in children’s understanding of conceptual knowledge around age 3 or 4 (when they shift to asking causal questions). In the current set of studies, I demonstrated that children use questions to acquire conceptual knowledge and understand that specific types of questions (e.g., ‘why’, ‘how’) require explanatory responses. These findings are consistent with previous work showing that children expect explanatory responses to their causal questions (Frazier, Gelman & Welman, 2009). However, this previous work did not consider individual differences and how this pattern of interaction may not be an optimal tool for acquiring conceptual knowledge for all children. Indeed, in the current set of studies, I showed how individual differences specifically socioeconomic status and epistemological beliefs impact the effectiveness of this interaction pattern.

The variability observed across the 5 studies presented in the current dissertation can be linked to differences in cognitive development. Children who are exposed to high-quality explanations that include evidence not only acquire more knowledge, but are also exposed to more sophisticated ways of thinking about the world. These children will likely enter formal schooling with a more extensive knowledge base and ability to use evidence to reason about problems. This ability can be linked to the development of critical thinking skills (Kuhn, 2002). As children reason about the world, those who have the ability to use evidence to support their claims will be likely be better prepared to navigate novel learning scenarios (I explore the implications for children’s learning further in Chapter 6). These data support the initial hypothesis that vocabulary
differences are not the only cognitive disadvantage that children from low-SES families face when they enter formal schooling. Additionally, these findings suggest children from low-SES families may not be the only ones who are at a cognitive disadvantage when entering formal schooling. Children from mid-SES families who are not exposed to high quality explanations that use evidence and examples may be at a disadvantage compared to their peers who are exposed to explanations that use examples, likely causing discrepancies in children’s critical thinking skills, which are crucial for the development of today’s learner.

Despite these findings, it is important to note that there were several limitations to the methods used. First, in Study 1, it is important to note that the corpus was from 1984. Given the influence of social context on children’s development (Bronfenbrenner, 1979), it is plausible that the nature of everyday conversations has changed over the past twenty years. Thus, these results should be interpreted with caution when thinking about today’s child, yet they provide an important first step at looking at differences in these patterns of interaction. In future research I plan to look at this interaction pattern in a more modern sample. Moreover, when looking at children’s follow-up in Study 1, it is important to interpret these results with caution as there were few cases for each type of follow-up. In future studies, where this coding scheme is applied, I plan to group follow-up in a similar way to how I grouped adult responses.

Second, as previously noted, when interpreting the results from Studies 2, 3 and 4, it is important to exercise caution when considering real world implications, as these studies were highly controlled and only accounted for one expression of explanation
quality (argument circularity). Indeed, future research is needed to look at other cues that children might monitor when using explanations as a tool to learn from others.

Lastly, in Study 5, it is important to highlight that this study was conducted in a naturalistic context. Therefore, it is difficult to make causal inferences. Although it is clear the caregivers’ epistemological stances are associated with the explanations they provide, it is unclear if these explanations cause children to learn more. In future research, I plan to conduct an experimental study where I control the explanations children hear in order to systematically explore if children actually learn from the explanations they hear.

In conclusion, the question, explanation, follow-up pattern of interaction does not look the same for all children. Indeed, all children ask questions, but the quality and types of responses they hear differs; impacting both their verbal and behavioral follow up. Understanding the interaction patterns children use as a tool for learning from others is critical to thinking about best teaching practices and creating culturally responsive classrooms. I consider how these early learning experiences may impact formal schooling in the following Chapter (Chapter 6).
Chapter 6: Significance and Implications

Children’s conversations with others facilitate the exchange of knowledge. In the current dissertation I used naturalistic observations and experimental methods to investigate one pattern of interaction that children use as a tool to learn from others. By using experimental methods, I was able to further support the findings from the naturalistic observations (Chapter 2). The findings from the 5 studies presented here have important implications for children’s learning. Indeed, children’s early interactions often influence their behaviors and interactions in the context of formal schooling.

The findings from Study 1 (Chapter 2) highlight the frequency with which children across diverse backgrounds ask information-seeking questions as a tool to learn from others. It is important for teachers to be mindful that children ask questions to acquire new knowledge and not simply to maintain attention (Chouinard, 2007). However, there is significant variability in how children respond when they receive unsatisfactory responses to their questions. Specifically, when children hear unsatisfactory responses to causal questions, mid-SES children provide their own explanations more frequently, indicating an understanding that these types of questions require explanations. In contrast, low-SES children do not follow-up as frequently and are more likely to drop their original question. Thus, they are less likely to be exposed to the explanations needed to make gains in the acquisition of conceptual knowledge. It is important for teachers to note that not all children will follow-up if they receive an unsatisfactory response. Therefore, teachers should not expect that the question,
explanation, follow-up pattern of interaction is privileged across all children. Accordingly, teachers need to be sensitive to this realization and adjust their pedagogy to reflect the interaction-patterns that children are exposed to in their early learning experiences with their caregivers. The data presented here suggest that teachers should not always wait for children to ask questions, instead they should work to spontaneously provide high quality explanations, especially when children are exploring entities that include causal mechanisms. These explanations are not only used for the acquisition of knowledge but also for children to build relationships with their teachers.

As demonstrated in Studies 3, 4 and 5, (Chapter 3) children use explanations to judge the credibility of an informant. In classroom settings the informant children most likely turn to is their teacher. Contrary to what one might expect, children do not blindly learn from their teachers.

Although experimental designs like those used in Chapter 3 are not always appropriate representations of what occurs in a classroom setting, they provide an important first step in systematically identifying the cues children employ when making decisions about which informants to turn to in learning situations. Indeed, although it is unlikely that children will be faced with two blatantly different explanations in a classroom setting, it is very likely that they will be exposed to multiple teachers within their classroom, and it is likely that these teachers will provide explanations that vary in quality. Moreover, children are constantly weighing the explanations they hear from their teachers against the explanations they hear from their parents. The type of forced-choice experimental research highlighted in Chapter 3
allowed me to isolate the cues children rely on most heavily in learning situations. The next step for future research is to ask how children weight multiple cues, which would be more analogous to a classroom situation.

Indeed, this recent set of studies, combined with the previous research looking at children’s evaluations of informants for single-word learning indicate that as children develop, they attend to epistemic cues more readily when deciding from whom to learn (Koenig, 2012). One important implication based on these findings is that teachers must be especially vigilant to avoid using circularity when answering questions. Our work and others suggest that by the time children enter formal schooling, children prefer high quality, non-circular explanations – at least in the case of mid-SES children (Authors, Baum, Danovitch & Keil, 2008; Mercier et al., 2014) – and selectively prefer to learn new information from someone who provides high-quality explanations. By implication, children may selectively avoid learning from someone who provides a lower-quality explanation – or a circular one. This is not to say that teachers ever willingly provide poor quality explanations. Yet recall the data highlighted in Chapter 1, that even well-meaning preschool teachers do not provide high-quality explanations for all of their students’ questions. After being barraged with questions, a teacher is apt to say something like “It is that way, because I said so.” It is important for teachers to note that children use these responses to make inferences about their future credibility. Note, Study 4 demonstrated that low-SES children prefer to learn from an informant who provides circular explanations. This poses a potential conflict for teachers because circular explanations are not ideal for providing children with the information needed
to acquire conceptual knowledge, but it is also important for their students to perceive them as a credible source. I propose that instead of teachers changing their explanations to be lower-quality (circular), that researchers consider an intervention that targets the quality of explanations caregivers offer their children so that children are exposed to non-circular explanations early on. It is important to note that I am not suggesting that children will not trust their teacher if she does not always provide high-quality explanations. Instead, teachers should view explanations as a tool to further developing their students’ epistemic trust in them as well as their emotional trust.

Furthermore, in the classroom context, I suggest that when teachers are asked questions that they do not know how to answer that they use a KWL chart (Carr & Ogle, 1987). That is, they help children to identify what information they already know about the topic, “K,” what they want to know about the topic (their question) “W,” and, after the teacher helps the student to locate the answer, what they learned, “L.” I recommend that teachers allocate a chart in their classroom for students’ questions. Teachers should find the appropriate answers to these questions and formulate a high quality explanation to report during a designated time. Note that children’s understanding of causality emerges around age 4; thus, prior to age 4, I suggest that teachers do not include causal language in their explanations, as children may not be able to accurately interpret these explanations (for a review on the development of causal understanding, see Gopnik & Meltzoff, 1997). Teachers should use their epistemological beliefs to facilitate the development of these explanations. As demonstrated in Study 5, teachers with evaluativist stances will likely use explanations
that provide evidence and example causing children to learn more. When a teacher does not have an evaluativist stance, she might not draw on previous examples or she might not be aware of the child’s previous experiences to build on. Therefore, it is important for early childhood educators to connect with caregivers to understand experiences that a child has had that a teacher might use to build knowledge from. For example, a teacher might consider sending home a survey at the beginning of each unit that asks caregivers if their child has visited specific places or have relatives who have specific jobs (e.g., a unit on farms, the teacher might ask parents if their child has ever visited a farm).

I believe children’s learning from explanations is important across multiple learning contexts. For example, in today’s math curricula, children are often presented with multiple explanations of how to solve a problem. If children rely on one explanation over the other and are unsuccessful, they may use that unsuccessful explanation to make an (incorrect) inference about the credibility of their teacher in the domain of math. Moreover, understanding how children learn from explanations might be especially important in the case of science learning. This is because the majority of phenomena can only be learned through the explanations provided to children by adults (e.g. what are germs? why is the sky blue?). Indeed, in recent years the educational framework used to promote science has been largely based on the premise of science as an argument (Kuhn, 2009). That is, scientific thinking can be viewed as a social activity that involves “defending” or “arguing” certain theories through explanation (Kuhn, 1991). With a new emphasis placed on Science curriculum and the
emergence of the Common Core Standards (2010), the Next Generation Science Standards (2013), and the Framework for K–12 Science Education (NRC, 2012), it is especially crucial that children are exposed to high quality explanations and arguments for scientific phenomena during the preschool years. Study 5 has important implications for science learning. Indeed, when a teacher adopts an evaluativist stance, they provide explanations that use more evidence and examples, leading children to learn from the explanations they hear. Teacher trainings, particularly in the preschool years, should target the epistemological beliefs of teachers. Indeed, if an expression of an evaluativist stance in explanations leads to greater learning, then teacher trainers should provide teachers with explanations that move beyond facts and use examples and multiple sources of evidence.

In addition, curricular materials should provide guidance not only on the content of the taught domain but also on the explanatory language to be used by the teacher. To my knowledge, few standardized curricula exist that provide useful explanations for teachers to use when teaching science during the preschool years. In fact the majority of curricula focus on science activities and content, but provide little guidance to teachers about the explanations to use when explaining the HOW and WHY specific phenomena exist (e.g., Dispezio, 2012; Macmillan, 2006,). This lack of curricular materials on explanatory structure is surprising, given the large body of literature focused on how classroom discourse – especially teacher discourse – plays a significant role in children’s acquisition of new knowledge (Cazden, 2001; O’Connor & Michaels 1996). When learning from explanations, children as young as 3
distinguish “good” reasons from “bad” reasons and prefer to learn from informant’s who “use” good reasons to support their beliefs (Koenig, 2012), thus demonstrating that children not only attend to the semantic structure of responses, but also to the quality of the explanation. Together, these cues contribute greatly to a child’s willingness to learn new information from an informant. Given these findings, policy makers might consider including benchmarks for pre-service around the quality of the explanations they provide. Indeed, early childhood teacher certification standards continue to remain an open question as they vary from state to state (doe.gov, 2015). As policy makers continue to refine these standards, it is important for them to consider the emphasis on teacher’s abilities to provide exemplary responses to children’s questions as a tool for developing conceptual and procedural knowledge in even the youngest of learners.

Finally, I believe the findings across these 5 studies highlight the importance of explicit interaction across teaching teams. Learning is a highly social experience, especially during the early years. Indeed, it is not the goal of education for children to blindly accept information from a trusted source without evaluation. Instead, educators aim to promote children’s ability to think critically about the information they receive from others (Heyman, 2008). This is especially true when children are in learning situations with multiple sources. As previously mentioned, it is common in preschool and early elementary classrooms to work in teaching “teams” (e.g., teachers, assistant teachers, aids, paraprofessionals, etc.). As a result, children have access to many different sources when learning about the world. The data from
Studies 2, 3 and 4 (Chapter 3) suggest that children might readily accept one teacher as more credible than another teacher based on the quality of explanations she provides and that the quality of explanations is directly linked to how much children learn (Study 5). To prevent such selective preferences for learning from one teacher over another, I urge teachers to be mindful not only about the content of their explanations, but on the linguistic context under which the explanation is provided. The ideal is for all teachers to provide high quality, and consistent, explanations. Thus, taking the time to discuss lesson plans and activities with all teachers in the classroom is crucial to promoting a community of learners. Despite this ideal, it may not always be attainable. Indeed, there is considerable variability in the training of preschool teachers (Heisner & Lederberg, 2011). Consequently, children from low-SES families are likely to be exposed to teachers who do not have as much training as those who teach in areas that service mid/high-SES children (Bradley & Corwyn, 2002). Although no research has systematically explored the link between teachers’ explanations and their training, one might hypothesize that teachers with less training are less apt to provide high quality explanations. This poses a potential challenge as preschool is an opportunity for children to become exposed to interaction patterns that are privileged in formal schooling, like the question, explanation, follow-up discussed in this dissertation. If classroom teachers have similar backgrounds to their students (e.g., they both come from low-SES families), then interaction patterns that are privileged in the home, might be perpetuated in the classroom and therefore children from low-SES families might not have the opportunity to be exposed to the question,
explanation follow-up pattern of interaction that is privileged in formal schooling. On the other hand, this might lead children to perceive their teachers as more credible learning partners as evidenced by Study 4.

Despite these important implications, I remain cautious about the implications of these findings for children’s use of explanations when learning across domains. Four of the five studies here present information specific to the science domain. Therefore, it is unclear whether or not children will extend their preferences for an informant (Chapter 2; Studies 2, 3 and 4) from one domain (e.g., science) to another domain (e.g., math). Likewise, because the evaluativist stance lends itself to the science domain (Chapter 4; Study 5), it is not clear if this would be the preferred expression to be used in explanations across other domains. More research is needed to determine if the findings I expect generalize to other domains.

In summary, I believe the results from this dissertation provide important implications for classroom teaching and learning. Children across diverse backgrounds use questions to acquire knowledge. The pattern of discourse that follows children’s initial questions varies as a function of the caregivers’ responses. When focusing on these responses influence children’s learning, it is clear that children not only monitor what is said, but how it is said. The current set of studies reveal that children do in fact learn from the explanations they hear and they also use explanations to make judgments about an informant’s credibility Thus, it is particularly important that teachers consistently provide children with high quality explanations across all learning domains. By doing so, teachers will not only enhance children’s conceptual knowledge, but they
will also build children’s epistemic trust, making their students more willing to learn from them in future learning tasks. Understanding the pattern of interaction that necessitates learning and whether or not children actually learn from the explanations they hear will further support the development of curriculum, pedagogical approaches, and culturally responsive practices.
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EDUCATION

2015  EdD in Human Development
      Boston University, Graduate School of Education, Boston, MA

2011  MA in Child Development
      Tufts University, Elliot Pearson Department of Child Development, Medford, MA

2009  BA, magna cum laude with Honors in Elementary Education
      BA, magna cum laude with Honors in Psychology
      Stonehill College, Easton, MA

2008  Butler University Study Abroad Program, Tutorials in: Psychological Research and Assessment, Developmental, Abnormal and Cognitive Psychology
      Oxford University, St. Edmund’s Hall, Oxford, UK

HONORS

2007–2009  Lambda Epsilon Sigma, Stonehill College
            President  National Honor’s Society

2009  Sigma Delta Pi, Stonehill College
       National Spanish Honor’s Society

2007  Psi Chi, Stonehill College
       National Psychology Honor’s Society

2006  Kappa Delta Pi, Stonehill College
       National Education Honor’s Society

AWARDS

National Competitions
2015  Division E Distinguished Research Award, American Educational Research Association

2014  Jumpstart Foundation Grant (co-recipient), Jumpstart Foundation
       $10,000 awarded to study the effects of an early-intervention program on promoting the development of critical thinking skills in preschoolers.
AWARDS (cont.)

2012 Division E Pre-conference Scholar, American Educational Research Association
$600 to 10 students to attend a pre-conference seminar focused on early career development.

2008 Student Travel Award, Association for Psychological Science
$300 for conference travel and expenses.

At Boston University
2014, 2012 American Educational Research Association Travel Award, Boston University
$1,000 to 10 students for conference travel and expenses.

2012, 2013 Graduate Research and Scholarship Award, Boston University
$500 to attend and present at the biennial Society for Research on Child Development conference and Cognitive Development Society conference.

2012, 2013 Continuing Student Scholarship Award, Boston University
Merit-based scholarship (partial tuition for 2-years, approx. $30 K/year).

At Tufts University
2011 Presidential Scholarship, Tufts University
Merit-based award for academic promise and leadership (50% tuition, approx. $18K)

At Stonehill College
2005-2009 Honors Scholarship, Stonehill College
Merit-based award for participation and achievement in Stonehill’s honors program ($14 K/per year)

2008 Summer Undergraduate Research Experience Scholar, Stonehill College
$5,000 for summer research in developmental psychology

PUBLICATIONS


**PUBLICATIONS (under review/revision)**


**PEER-REVIEWED CONFERENCE PRESENTATIONS**


PEER-REVIEWED CONFERENCE PRESENTATIONS (cont.)


PEER-REVIEWED CONFERENCE PRESENTATIONS (cont.)


PROFESSIONAL DEVELOPMENT CONFERENCE PROCEEDINGS


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**RESEARCH EXPERIENCE**

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<td>2012–present</td>
<td><strong>Social Learning Laboratory, Graduate Student Researcher</strong>, Boston University</td>
<td>Principal Investigator: Dr. Kathleen Corriveau</td>
<td>Design and execute research projects that examine cues children use when learning from others. Co-supervise undergraduate and graduate research assistants.</td>
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<tr>
<td>2010–present</td>
<td><strong>Research Institute for Learning and Development, Curriculum Designer</strong>, Lexington, MA</td>
<td>Principal Investigator: Dr. Lynn Meltzer</td>
<td>Created, implemented and iteratively revised an evidence based curriculum and peer mentoring program focused on Executive Function for students with learning and attention difficulties.</td>
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<tr>
<td>2010–2011</td>
<td><strong>East Boston Family Values Study, Research Assistant</strong>, Research Assistant, Tufts University</td>
<td>Co-Principal Investigators: Dr. Martha Garcia-Sellers and Dr. Jerome Kagan</td>
<td>Master’s thesis: “I think he can”: Mother’s ability mindsets and the development of cognitive trust in toddlers</td>
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<td>Designed training videos of an early intervention program for Spanish, Portuguese, and White American populations. Assisted in the development and implementation of a comprehensive coding system for the data collected from Latin American families who participated in the study.</td>
</tr>
<tr>
<td>2009–2010</td>
<td><strong>The Center for Reading and Language Research, Research Assistant</strong>, Tufts University</td>
<td>Principal Investigator: Dr. Maryanne Wolf</td>
<td>Evaluated Spanish speaking adolescents for Reading Disabilities using an assessment battery designed by Dr. Maryanne Wolf in collaboration with Yale University</td>
</tr>
</tbody>
</table>
PROFESSIONAL EXPERIENCE

2010–Present  **Institute for Learning and Development, Lexington, MA**
*Educational Therapist*
Work with students of all ages with learning and attention difficulties in a small group setting to provide individualized educational services. Implement strategy-based instruction using curricula including: Project Read, Wilson Reading System, Lexia, and Marilyn Burns Mathematics.

2010–2012 **Research Institute for Learning and Development, Lexington, MA**
*Community SMARTS, Program Coordinator*
Designed and implemented monthly activities for a clinical mentoring program for adolescents, and elementary children with learning and attention difficulties. Used a peer-mentoring model to develop motivation, awareness, resilience and academic success in students with disabilities.

2012–2013 **International Academy for Research on Learning Disabilities, Boston, MA**
*Conference coordinator for 2013 annual conference*
Assisted in organizing an international conference for scholars focused on Learning Disabilities. Created protocols for future conferences and reviewed submissions for symposia and poster sessions.

2009–2010 **Arnone Elementary School, Brockton, MA**
*4th Grade Teacher*
Taught a class of 24 diverse students in an urban setting. Designed innovative lessons to engage all learners. Collaborated with 3 other 4th grade teachers to ensure benchmarks were met. Fostered relationships with parents and other colleagues to help promote social, emotional and academic success for all students.

TEACHING EXPERIENCE

**Instructor**
Graduate methods course
Boston University, School of Education

PSY 1100: Psychological Inquiry and Methods in Human Development, *Fall 2014, Spring 2015*
Two sections of an Undergraduate methods requirement Merrimack College, North Andover, MA

**Co-Instructor**
DS 600: Culture, Race and Ethnicity, *Summer 2013*
Graduate level elective
Boston University, School of Education
TEACHING EXPERIENCE (cont.)

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<td>Boston University, School of Education</td>
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<td>Kathleen Corriveau</td>
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<td>Teaching</td>
<td>CD 197: Learning and Attention Difficulties: Assessment and Teaching, Fall 2010, Fall 2011</td>
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<td>Accounting for discrepancies in cues children use when learning from others: A story book intervention, 2013-present</td>
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<td>Research Co-Supervisor</td>
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<td>Preschoolers Development of Executive Function Strategies, 2012-present</td>
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<td>Jason Chin, Boston University, BA expected 2015</td>
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<td>Rachel Bell, Boston University, BA expected 2016</td>
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<td>Cues Children Use When Learning from Explanations, 2012-present</td>
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PROFESSIONAL ACTIVITIES

**Ad-hoc Reviewer**
- Learning Disability Quarterly
- Child Development
- Developmental Psychology

**Member**
- International Academy for Research on Learning Disabilities
- American Educational Research Association
- American Psychological Association
- Association for Psychological Science
- Cognitive Development Society
- Society for Research in Child Development