Trust Matters:
Measuring preschoolers’ epistemic and interpersonal trust in teachers

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Abstract

Knowledge derived from the testimony of others is a ubiquitous part of human learning. Children rely on others to learn information about scientific facts, historical events, and cultural and social practices. Abundant experimental work has revealed that children’s learning from testimony is selective, guided by considerations about the epistemic and social qualities of agents. The extant work in this literature has conceptualized this selectivity as showcasing epistemic trust – trust that is extended based on evidence about agents. However, social transactions are fundamental to testimonial exchanges and are difficult to situate within a purely evidential framework, leaving open the possibility that social considerations reflect a distinct variety of trust that has not been measured in this literature. To this end, the studies here offer an initial attempt to define and measure two varieties of trust and to examine how these distinct varieties of trust impact children’s learning in an applied setting. Since teachers express a range of epistemic and interpersonal behaviors, some of which have been actively evaluated by preschool-aged children in experimental contexts, preschool classrooms were chosen as a natural setting to investigate the nature of epistemic and interpersonal evaluations as they develop in the course of a relationship with a teacher. Across two studies, children’s epistemic and interpersonal trust in an adult teacher was examined using two 10-item evaluations that were created to assess children’s ratings of epistemic trust (the extent to which they viewed their teacher as having knowledge across different situations and domains) and interpersonal trust (the extent to which they viewed their teacher as a source of help or comfort across different situations). Study 1 (N = 63 3- and 4-year-olds) experimentally manipulated the behavior of an adult teacher in order to test for predicted
differences in epistemic and interpersonal trust as a function of condition. Study 2 (N = 43 3- to 5-year-olds) explored whether variation exists in preschoolers’ epistemic and interpersonal trust in an applied setting by asking children to report on their trust in their lead teacher twice over the course of an academic year. In both studies, children’s learning and memory for information taught to them by their teacher was assessed, and hierarchical regression analysis was used to test for associations between trust and learning controlling for child demographics and cognitive abilities. Epistemic trust varied as a function of condition (Study 1) and teacher (Study 2), offering initial support for distinguishing between epistemic and interpersonal trust. While neither form of trust was associated with learning, suggestions are made for future work exploring the associations between trust and learning. Taken together, these studies offer new directions for exploring children’s trust and the impact that it has on learning and offers an initial step in translating empirical work on children’s selective epistemic trust to more applied contexts.
This dissertation is dedicated to my Grandpa, Faustino “Frosty” Martinez.
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Background
Learning from and trusting in testimony

Learning from the testimony of others is a ubiquitous part of our day-to-day lives, allowing us to learn about and engage in various social and cultural practices. Testimony allows us to learn about the unobservable, including historical events, scientific facts, and cultural rites and rituals. Testimony can broaden the scope of our knowledge beyond our own first-hand experiences, and the study of testimonial learning has important implications for understanding both how we assess claims as well as whom we decide to believe. A growing literature has documented children’s testimonial learning decisions. Importantly, this work shows that by the preschool years, children prefer to learn from agents who are more accurate (Koenig & Harris, 2005; Koenig, Clement, & Harris, 2004), knowledgeable (Einav & Robinson, 2011), and well-informed (Kushnir, Gelman, & Wellman, 2008). In addition, preschoolers monitor probabilistic or relative evidence about accuracy (Pasquini et al., 2007; Einav & Robinson, 2010), evidence about perceptual access to relevant information (Nurmsoo & Robinson, 2009; Povinelli & deBlois, 1992), and overt evidence about expertise (Koenig & Jaswal, 2011; Kushnir, Vredenburgh, & Schneider, 2013; Lutz & Keil, 2002). This body of work demonstrates children’s selective or epistemic trust – the ability to reason about and appropriately use evidence about agents to guide learning decisions.

Various theoretical accounts have been advanced to explain children’s extensions of epistemic trust. On one account, children’s epistemic trust is argued to involve evaluations of both knowledge (e.g. access, expertise) and intent (benevolence, helpfulness) (Shafto et al., 2012). More specifically, Landrum, Eaves, and Shafto (2015)
argue that a learner engages in a two-part inference – the first, “learning to trust,” which draws upon the learners’ own knowledge base as a way to corroborate the veracity of a claim. The second, “trusting to learn,” considers prior trust in the specific agent or social markers typical of agents that have been trusted in the past to decide whether or not to believe novel information. Similarly, Sobel and Kushnir (2013) argue that extensions of epistemic trust reflect a rational inference, one that children make after gathering relevant evidence, checking their background knowledge, and inferring the likelihood of the communicated information being correct (Sobel & Kushnir, 2013). A more recent proposal argues for a dual-process account of epistemic trust. Hermes et al. (2018) suggest that there are Type I and Type II processes at work in children’s execution of selective trust; specifically, Type I reasoning involves simple, quick heuristics that can swiftly aid in identifying the better of two sources (e.g. whom differ in obvious ways, such as accuracy) whereas Type II reasoning involves more sophisticated reasoning, incurred with advances in general knowledge and cognitive resources.

These views are largely guided by the overarching ideology that children’s selectivity is a rational process, which considers evidence about an agent’s likelihood of having truthful or accurate information. Evidential accounts, however, conflate two potentially distinct processes involved in testimonial learning. When children accept a testimonial claim, they are both learning new information as well as trusting in the agent to have provided truthful information. Thus, central to the task of learning from testimony includes considering what is needed to learn from others and the nature of placing trust in others. Learning from others requires acknowledging when there are gaps in one’s own knowledge, and determining how and from whom to get the desired
information. Thereafter, one should assess the truthfulness of a set of claims, actively assessing the competencies and intentions of the sources. Central to this is a cognitive support system, that includes the ability to reason about the mental states of others (to avoid being deceived or lied to), to use executive function to attend to and inhibit learning from poor sources, and source and content memory to retain information about sources and the information obtained from them. Trusting others, on the other hand, may involve more social or interpersonal considerations, and could be impacted by early relationship experiences. For example, Erik Erikson’s first stage of psychosocial development suggests that children learn to trust or mistrust based on their caregivers’ responsiveness to basic needs. Bowlby’s theory of attachment emphasized that children develop an internal working model, or a set of representations constructed from early experiences with the caregiver, which guides interactions with others throughout life.

Within the selective trust in testimony literature, emphasis has been placed on the cognitive mechanisms and individual differences that support learning from testimony. Less considered, however, is how trusting others impacts these learning decisions. While epistemic trust has become the technical term used to describe children’s learning, trust has received less conceptual attention. The concept of trust has been conceptualized and studied across a variety of disciplines, and by appealing to these notions of trust, we may be better positioned to examine the role that trust plays in learning beyond abilities that support children’s ability to discern better sources based on evidence. Indeed, as a source of knowledge, testimony is unique because it is interpersonal, requiring reliance on others for information, or trust in others for the truth (McMyler, 2011). If trust is implicated in children’s learning from testimony, then it will be important to consider not only the
cognitive resources needed to engage in source monitoring, but also the social goals and motivations that children have to learn from certain individuals over others.

**Distinguishing epistemic and interpersonal trust.**

Within the epistemology of testimony, philosophers have contemplated varied notions of trust. Some have contrasted the concept of trust with belief. In a well-known example by Richard Holton (1994), readers were asked to consider a situation in which you are about to fall backwards into the arms of a person who has promised to catch you. You may trust that person to catch you, because you think that they have goodwill towards you (Baier, 1986), but do you believe that they will catch you? One’s belief in this situation may not manifest until the outcome has been produced (i.e. you have been caught). Trust, in this example, can be thought of as an attitude or investment in another person to convey truthful information to you, distinct from believing that you have received accurate information. Echoing this, philosopher Gloria Origgi has argued that “epistemic trust is trust, on the one hand, in the goodwill of others, and, on the other hand, in their competence.” Origgi (2004) distinguishes between different versions of trust, with moral trust being sensitive to the goodwill signaled by agents and epistemic trust as a reflection of competence.

Empirical examples from the economics literature also suggest that interpersonal and epistemic forms of trust are distinguishable. For example, economists Johnson and Grayson (2005) argue that there are distinct cognitive and affective dimensions of trust in business-consumer relations. Specifically, they suggest that trust in a relationship requires some degree of uncertainty or a “leap of faith.” This uncertainty begins where cognitive evaluations of competency and reliability end and relies on an affective state, or feeling,
about the trustworthiness of the person with whom you are interacting with (Johnson & Grayson, 2005). They distinguish between cognitive trust and affective trust, where cognitive trust is influenced by judgments about an agent’s expertise about a subject and affective trust is influenced by judgments about an agent’s similarity to you and your level of satisfaction with prior interactions with that agent (Johnson & Grayson, 2005). This work suggests that there are two distinct types of trust with unique antecedents. Supporting this, a study found that cognitive features of trust (such as frequency of interaction and reliability) are less important when an emotional bond or “liking” with an agent has been developed (Nicholson et al., 2001). Specifically, participants reported liking of a business mediated the relationship between frequency of interaction with that business and trust (Nicholson et al., 2001). Taken together, this work suggests that there may be distinct domains of trust – cognitive and affective – and that affective trust replaces or dominates cognitive trust in close, interpersonal relationships.

For social psychologists, interpersonal trust has been the dominant way of conceptualizing and measuring trust. Many definitions of interpersonal trust from social psychologists echo the sentiments expressed in accounts of epistemic trust. For example, Julian Rotter defines interpersonal trust as “an expectancy held by an individual or a group that the word, promise, verbal or written statement of another individual or group can be relied upon” (Rotter, 1980). More recently, Ken Rotenberg has argued for his 3 bases X 3 dimensions X 2 target dimensions model (BDT) of interpersonal trust. The BDT model captures various bases and dimensions of trust, touching on both social and cognitive reasons that we have to trust others (Rotenberg, 2012). In line with epistemic trust, the BDT model includes both reliability and honesty as important bases for trust.
Going further, though, the model also includes emotions as a base for trust, highlights that there are both cognitive and affective domains of trust, and considers that interpersonal trust will be different depending on familiarity and specificity of the situation.

**New directions.**

Distinguishing between epistemic and interpersonal trust is supported by interdisciplinary work across philosophy, economics, and psychology. One avenue for investigating the potentially distinct role for epistemic and interpersonal trust in testimonial learning decisions is to examine learning in more ecologically-valid contexts. This includes both in-person interactions for laboratory-based work, as well as investigating classroom experiences with teachers whom children have developed relationships with. Currently, there is little work investigating the extent to which children’s selective trust – as documented in the lab – functions in more day-to-day learning opportunities. Taking concepts from philosophy and economics has the potential to expand our understanding of the role for trust in testimonial learning. First, it will allow researchers to begin to understand whether selectivity on laboratory selective trust tasks is normative across other, more realistic contexts. Second, understanding how distinct forms of trust affect decisions to learn will aid in theorizing about the concepts and mechanisms that support learning. Third, it will expand our understanding of how individual differences in trusting dispositions influence learning.

Although the developmental field has not yet focused on how children view the epistemic and interpersonal characteristics of their teachers, more general notions of trust and its relation to learning has been documented in the educational psychology literature.
Across various studies, trust plays an important role in a variety of student outcomes, especially for students from diverse socioeconomic and racial backgrounds. For example, teacher-reported trust in students has been found to be a predictor of student academic achievement, controlling for school size and prior academic achievement (Goddard et al., 2009). Peer nominations of student trustworthiness (e.g. ability to keep promises and secrets) was found to predict teacher-reported school adjustment (Betts & Rotenberg, 2007). Teacher-reported teacher-student relationship quality of children in kindergarten predicted students’ math achievement in first grade (McCormick et al., 2013). Finally, African American middle schoolers’ acceptance of criticism and praise for school work from their teachers was supported by higher levels of student-reported trust in the school (Yeager et al., 2013). This body of work suggests that trust in educational settings leads to more positive student outcomes. However, this literature is inconsistent in the methods used - relying on teacher or student reports of general notions of trust (e.g. “students in this school are reliable”, “I am treated fairly by teachers at my school”) that are not specific to a particular student or teacher, which leaves unclear the specific epistemic and social characteristics of teachers that cultivate trust. Moreover, this work has not investigated the role that trust plays in early learning experiences, despite work showing the importance of prekindergarten (pre-K) and kindergarten quality on later academic performance and achievement (Sabol et al., 2013; Morgan et al., 2016; Barnett, 2012). Thus, little is understood about (1) the distinct and independent types of trust that exist, (2) how they function in specific student-teacher relationships, (3) and how each type of trust supports academic outcomes.
With measurable variability in how teachers interact with students, applied work on testimonial learning can investigate the extent to which children execute epistemic trust in the classroom and whether it is distinguishable from interpersonal trust. By independently assessing children’s epistemic and interpersonal trust, we can better understand whether children actively evaluate their teacher’s epistemic or interpersonal characteristics, and how these evaluations might influence their decisions to engage and learn in the classroom.

**Aims of the current studies.**

Knowledge derived from testimony or instruction is ubiquitous in children’s interactions with teachers. Central to understanding how trust functions in these opportunities to learn is distinguishing how different varieties of trust influence learning. My work has been among the first to suggest that distinct forms of trust differentially affect preschool-aged children’s practical and learning decisions. Specifically, I found that agents who failed to uphold commitments reduced 3- and 4-year-old’s decisions to share with and wait for a larger reward from that agent, but did not reduce their willingness to learn novel information from her (Pesch & Koenig, 2018). Consistent with other work showing dissociated judgments amongst preschoolers when given evidence to “mistrust” an agent (Hetherington, Hendrickson, & Koenig, 2014; Michaelson & Munakata, 2016; Kidd et al., 2013; Landrum, Pflaum, & Mills, 2015), I have argued that factors that support strong learning outcomes not only include evidential considerations and cognitive abilities, but also interpersonal and social judgments (Pesch, Suárez, & Koenig, 2018; Ridge, Pesch, Suárez, & Koenig, 2018). If this is true, then it is important to clarify and distinguish ways in which learning outcomes are affected by extensions of
epistemic trust and interpersonal trust. To this end, this dissertation work was guided by the following aims:

**Aim 1. Examine the range of variation and independence of epistemic trust and interpersonal trust in preschoolers’ assessments of teachers.** Due to limited work investigating these distinct varieties of trust, two 10-item questionnaires were developed with questions targeting interpersonal and epistemic trust, respectively, based on existing experimental work assessing children’s knowledge judgments (Lutz & Keil, 2002) and prosocial judgments (Johnston, Landrum, & Mills, 2013) about adults. Children’s responses to these questions were compared to other measures used in the literature to assess epistemic trust (Jaswal, 2004) and interpersonal/prosocial behavior (e.g. a sharing task, Moore (2009)).

**Aim 2. Examine children’s learning and memory for information in relation to both forms of trust.** Much of the work on children’s selective epistemic trust has relied on ask and endorse questions to assess learning (Koenig & Harris, 2005). As the current work aimed to evaluate learning in classroom contexts, learning was measured here by asking children to respond to open-ended recall questions about a set of facts that were taught to them by an adult teacher. This reflects the type of learning situations encountered in classroom settings, and the ways in which learning is assessed in these settings.

To address these aims, two studies were conducted, described below:

**Study 1** reports the results from an experimental study that was conducted with 3- and 4-year-old children (N = 63). The purpose of this study was to experimentally manipulate and control behaviors expected to naturally occur in classroom settings in
order to test for predicted differences in epistemic and interpersonal trust assessments as a function of condition. Second, associations between children’s recall and their trust was examined using hierarchical regression analyses controlling for age, condition, and working memory. The assessments were completed in one testing session, allowing for more control over timing of the memory assessments.

**Study 2** reports the results from a quasi-longitudinal study that was conducted with 3- to 5-year-old children (N = 43) enrolled in the Shirley G. Moore Laboratory preschool located at the University of Minnesota. The purpose of this study was to examine whether variation exists in preschoolers’ extensions of epistemic and interpersonal trust in an applied setting, without manipulating aspects of teacher behavior. Children were assessed twice to examine whether epistemic or interpersonal trust changed over time. Further, children were drawn from four mixed-age classrooms, allowing for analyses examining whether variation exists across trust type or teacher.

Across both studies, children’s epistemic and interpersonal trust in an adult teacher was examined by having children respond to the two 10-item trust assessments. In addition, in both studies, children’s learning was assessed by asking them to respond to open ended recall questions from a target teaching lesson led by an undergraduate research assistant (Study 1) or the child’s lead teacher (Study 2). All children were given a selective trust task (adapted from Jaswal, 2004) and a resource allocation task (adapted from Moore, 2009). These assessments were used to examine whether children’s epistemic and interpersonal trust – as measured with the 10-item assessments – was associated with other measures assessing knowledge and benevolence. Finally, children’s
working memory was assessed using a word span task, which was included as a covariate in hierarchical regression analyses.

Trust has been found to be an important predictor of school success. However, it is currently unclear how trust functions in human decisions to learn, especially when trust is parsed out to reflect the distinct interpersonal and epistemic reasons that children have to trust others. This dissertation is the first to investigate how distinct forms of trust function in decisions to learn by assessing how children’s evaluations of adults’ interpersonal and epistemic trustworthiness affects information processing. Although children have been shown to distinguish between agents based on a range of epistemic and interpersonal characteristics in the laboratory, an improved ecological approach to children’s learning from others has the potential to reveal how epistemic, interpersonal, and general indices of trust guides learning and memory in real world contexts.
Study 1: Measuring preschoolers’ epistemic and interpersonal trust and its impact on learning

Introduction

‘Trust’ in testimony. Abundant research has documented preschool-aged children’s ability to distinguish between agents who differ in epistemic and social characteristics, showing preferences to seek out and endorse claims made by agents who have positive epistemic and social qualities (Tong, Wang, & Danovitch, 2020; Harris et al., 2018). Many scholars have argued that children’s selectivity - their epistemic trust - is an important cognitive achievement, one that allows them to reason critically about evidence and to use it to protect against misinformation (Sobel & Kushnir, 2013; Mills, 2013). However, a puzzling set of experiments report that children sometimes learn from deceptive sources (Vanderbilt, Heyman, & Liu, 2014; Heyman, Sritanyaratana, & Vanderbilt, 2013) and privilege certain social characteristics over epistemic ones, including preferences for agents who share their racial group (Chen, Corriveau, & Harris, 2013), gender (Boseovski, Hughes, & Miller, 2016), and accent (Corriveau, Kinzler, & Harris, 2013). In these cases, it is less clear how to interpret children’s decisions. While some have argued that these findings reveal a lack of evidential reasoning, other work has begun to consider how social and interpersonal goals might function in children’s selective learning decisions (Kondrad & Jaswal, 2016; Tong, et al., 2020). Indeed, social transactions are fundamental to testimonial exchanges and are difficult to situate within a purely evidential framework (Pesch & Koenig, 2018; Pesch, Suárez, & Koenig, 2018).

‘Trust’ in other disciplines. One possibility is that children’s decisions to learn from others are guided by different trusting dispositions. The trust in testimony literature
has focused primarily on one notion of trust, epistemic trust, which has been conceptualized as trust that is sensitive to evidence about an agents’ ability to transmit truthful information (Koenig & McMyler, in press). However, scholars across a variety of disciplines have investigated and defined trust differently. Work in social psychology, economics, and philosophy have investigated the interpersonal or affective side of trust. Some have argued that extensions of interpersonal trust differ depending on the target (familiarity) and basis for trust (reliability, honesty, emotional trust) (Rotenberg, 2012), while epistemic trust applies equally to any source of information that can be estimated for its reliability. Philosophers make a parallel distinction by distinguishing practical trust (trusting someone to do a certain thing, or to refrain from doing some act) from epistemic trust (trusting a source for true, reliable information) (Goldberg, 2010; Faulkner, 2011). In consumer relations, work with adults supports a similar distinction, showing that there are distinct cognitive and affective dimensions of trust in business-consumer relations (Johnson and Grayson, 2005). For example, cognitive features of trust may be less important when an emotional bond or “liking” between two individuals is developed (Nicholson, Compeau, & Sethi, 2001).

In addition to the distinct domains of trust that have been investigated by various developmental scientists and economists, other work asks more broadly how general trust views, or dispositions to view others as generally trustworthy, affect certain decisions. For adults, low socioeconomic status has been shown to impact decisions to delay larger rewards (e.g. financial gains) for smaller, immediate rewards (Jachimowicz et al., 2017), arguably because individuals living in impoverished environments do not trust that a larger reward will materialize. However, adults living in impoverished communities were
found to increase their willingness to delay rewards when they reported a greater sense of community trust (i.e. general trust in their neighborhood) (Jachimowicz et al., 2017). Recent work with preschool aged children has similarly found that children’s general trust views predict willingness to delay gratification (Ma et al., 2018), suggesting that children’s general tendency to view others as trustworthy may be an important indicator of whom they are willing to trust.

While this and other interdisciplinary work distinguishes between different forms of trust, there have been few direct attempts to measure and document the impact of interpersonal and epistemic trust on children’s learning and behavior. There is some work offering preliminary support for these two varieties of trust. In one recent study, the impact of an agent’s direct bids for interpersonal trust on children’s learning and practical decisions was investigated. When an agent failed to uphold her commitments, thus failing in her bid for interpersonal trust, children were less likely to share a limited resource with the agent and to wait for a future reward promised by that agent but were willing to learn new information from her (Pesch & Koenig, 2018). Thus, while children’s interpersonal trust in the agent was weakened by interpersonal faults, their epistemic trust remained unchanged. In another study, Rowles and Mills (2018) contrasted social engagement with competence to assess whether preschoolers would seek out competent or socially engaged agents while completing a difficult puzzle task. Contrary to their predictions, preschoolers were more likely to solicit help from the incompetent, socially engaged actor despite acknowledging that the other agent was more competent at the task (Rowles & Mills, 2018). This suggests that evidential considerations may carry less weight in learning decisions when competing with interpersonal values, such as social engagement.
While it is clear that children’s learning from others involves a variety of considerations, the reviewed literature here suggests that interpersonal values may play a prominent, perhaps distinct role in preschoolers’ learning decisions. Attempting to place interpersonal values within an evidential framework might stifle investigations of trust and learning. By taking seriously the possibility that distinct forms of trust exist, researchers might be in a position to better document and understand how distinct varieties of trust function in children’s learning - opening up avenues for exploring individual differences in learning decisions and the impact of relationships on children’s learning. The present work offers an initial attempt to better define and measure two varieties of trust and to examine how these distinct varieties of trust impact children’s learning.

A new approach: Defining and measuring epistemic and interpersonal trust.

Though many scholars acknowledge that social goals and motivations can underlie children’s learning decisions, it has been primarily chalked up to either accumulated social evidence that an agent is epistemically trustworthy (Hermes, Behne, Rakoczy, 2018), or a bias that impedes on critical thinking and epistemic trust (Brosseau-Liard, 2017). However, it may be that interpersonal trust can actually support or strengthen learning in ways that we have failed to fully address, and which has the potential to impact how we think about child learning across a variety of contexts and individuals. To this end, I offer the following ways of defining and measuring epistemic and interpersonal trust.

**Epistemic Trust:** Trust that is impacted by evaluations of how reliable or knowledgeable someone is. Epistemic trust is sensitive to the knowledge states of an
agent and can be strengthened or undermined by evidence about an agent’s knowledge, reliability, and access to information. In the following study, to examine children’s inferences about how epistemically trustworthy an agent is, they will be asked to evaluate how knowledgeable an agent is across various scenarios and domains. Experiments with preschoolers demonstrate that children can infer who is likely to have expertise in specific domains of knowledge; for example, they infer that car mechanics are experts about bikes and cars and that doctors are experts about biological functions (Lutz & Keil, 2002). To evaluate how much children trust an agent to have knowledge about certain topics, they will respond to questions assessing domains of knowledge and expertise.

Interpersonal Trust: Trust that is impacted by evaluations of how prosocial, nice, or similar an agent is. Interpersonal trust is sensitive to cooperative aspects of a relationship and joint collaboration, including contingent responses, commitments to help, and apologies. To examine children’s inferences about how interpersonally trustworthy they feel an agent is, they will be asked to evaluate how prosocial or nice an agent is across various scenarios. Questions drawn from existing work examining children’s moral judgments (Johnston, Landrum, Mills, 2013) and benevolence judgments (Rowles & Mills, 2018) will probe how much children trust a target agent to help them or fulfill commitments.

The current study. The majority of the developmental work on testimonial learning has been conducted in laboratory settings with the use of experimental designs. It is clear from this work that preschool-aged children are capable of making epistemic and interpersonal appraisals of agents in controlled experimental designs. However, in the current work, the goal was to better understand how more natural interactions impact
children’s trust and the extent to which differentiated forms of trust impact learning and memory. Recent work has shown that children hold adults more accountable, by protesting when an adult provides inaccurate information, in live interactions in which they are directly addressed relative to being indirectly addressed (Li & Koenig, in press). Such work suggests that when children are directly engaged with another adult, they may be more sensitive to cues of interpersonal and epistemic trustworthiness. It remains an open question how more natural, day-to-day types of interactions that children have with adults around them (e.g. parents and teachers) are evaluated. Moreover, it is unclear how evaluations of trust impact learning in more natural interactions.

To address these questions in the current project, an adult directly interacted with participating children, and in order to place the interaction within a context of learning, the adult taught the child new information. Two learning situations were developed, with the goal of manipulating epistemic and interpersonal cues that were expected to impact children’s evaluations of how trustworthy they viewed the adult. In the first learning condition, the adult taught children new information in a highly interpersonal, but low epistemic way. Specifically, the adult sat with the child at a small table and expressed excitement about learning (“I’m so excited to learn with you”) and provided encouragement (“You’re doing a great job!”), but claimed to know very little about the information (“I don’t know anything about this animal. I’ve never seen it before.”). In the second learning condition, the adult taught children in a highly epistemic, low interpersonal way. The adult stood across from the child and expressed her knowledge about the material (“I know everything about this animal. I’ve seen it before”), but provided no direct encouragement opting instead to reiterate facts about the situation.
(“You’re in the learning room. You’re going to learn new things today”). The two conditions were meant to reflect learning situations children may encounter in real life (e.g. in classrooms). Following the learning phase of the study, the adult teacher left and a neutral experimenter asked children to respond to a set of follow-up assessments. Children were asked a set of memory recall questions to assess their memory for the information just taught to them. Children then responded to two 10-item assessments assessing interpersonal and epistemic evaluations about the adult teacher. After this, children responded to a set of explicit judgment questions, a selective learning task (Jaswal, 2004), and a resource allocation task (Moore, 2009). Finally, children’s working memory was assessed, and long-term memory for the information was assessed by re-asking the memory recall questions.

Evidence of meaningful variation in children’s epistemic and interpersonal evaluations of the adult would suggest that preschoolers are not only attentive to differences in epistemic or sociomoral characteristics of agents in controlled experimental designs, but also in more natural interactions in which no direct information about the agent’s epistemic or moral status is given. In the context of the current design, it was expected that children’s epistemic trust would be lower for the high interpersonal, low epistemic adult when compared to the high epistemic, low interpersonal adult. In contrast, children’s interpersonal trust was expected to be higher for the high interpersonal, low epistemic adult when compared to the high epistemic, low interpersonal adult. A second goal was to examine how trust impacts learning. To this end, if children’s learning and memory is supported by interpersonal trust (i.e. reasons to trust that are rooted in considerations of affiliation or affect), then interpersonal trust
scores should predict short- and long-term memory recall above and beyond epistemic trust and other covariates (age, working memory). On the other hand, if children’s memory is supported by epistemic trust (i.e. reasons to trust that are rooted in considerations of knowledgeability or expertise), then epistemic trust scores should predict short- and long-term memory recall above and beyond interpersonal trust and other covariates.

**Method**

**Ethics Statement.** This study was approved by the Institutional Review Board at the University of Minnesota (IRB ID: STUDY00006095). A parent or guardian provided written consent and children provided verbal assent to participate. These data were collected between July 2019 and March 2020.

**Participants.** Sixty-three children (35 girls), including 29 3-year-olds (M = 44.5, SD = 2.91, Range = 36.30 - 47.90 months, 17 girls) and 34 4-year-olds (M = 51.38, SD = 2.88, Range = 48.30 - 59.80 months, 18 girls) participated in this study. An additional 4 children were excluded due to failure to complete the study (n = 2) or experimenter error (n = 2). While this sample size fell short of the target sample size (n of 85) needed to obtain 80% power to detect a medium effect size, data collection was cut short due to COVID-19. The current sample size had 60% power to detect a medium effect size and 95% power to detect a large effect size. Participants were recruited from a university-maintained database at the University of Minnesota. Participating children were primarily Caucasian (84%). Parent reported income was primarily middle to upper class, with 70% reporting an annual income greater than $100,000 per year.
Procedure. Half of the children were randomly assigned to the High Interpersonal, Low Epistemic Condition (N = 31, 14 3-year-olds and 17 4-year-olds, 18 girls) and half were assigned to the High Epistemic, Low Interpersonal Condition (N = 32, 15 3-year-olds and 17 4-year-olds, 17 girls). All children were introduced to an adult “teacher” who taught them facts about a novel animal and demonstrated how to use a new object. In the High Interpersonal, Low Epistemic condition, the teacher taught the child information using a child-centered approach, which included making statements about learning together (“I’m so excited to learn about this new animal with you”), providing encouragement (“You’re doing a great job today!”), and sitting with the child at a small classroom table. About the facts and demonstrations, the teacher professed ignorance, claiming “I don’t know anything about this animal. I’ve never seen it before.” In the High Epistemic, Low Interpersonal condition, the teacher taught the child information using a teacher-centered approach, which included making statements about the setting (“You’re in the learning room and today is Monday”), the importance of learning (“You’re going to learn about a new animal today”), and standing across from the child who sat at a small classroom table. She exuded confidence in the material by making assertions about knowledge (“I know everything about this animal. I’ve seen it before”). Children’s memory for the information they learned was assessed both immediately after the teaching phase and again approximately 15 minutes later (after the word span task). Children’s interpersonal and epistemic trust in the adult teacher was examined by asking them to respond to a series of yes/no questions related to knowledge (e.g. “Some people know a lot about new animals, does she know a lot about new animals?”) and prosocial behavior (e.g. “Some people help others when they need help,
does she help others?”). Children’s decisions to learn new information from the teacher, to share stickers with the teacher, and their explicit judgments about knowledge and niceness were assessed. Finally, children’s working memory, a measure of executive function (EF), was assessed using a word span task.

**Teacher Behavior.** An adult research assistant taught each participant about a novel animal and demonstrated how to use a new object. The way the information was delivered differed as a function of Condition. The interactions in each Condition were scripted to ensure that participants received the same type of interaction within and across condition and were designed to reflect behaviors and statements that are expected to naturally occur in classrooms. In addition, the teacher scripts were matched with respect to the number and type of statements made to ensure similar lengths of interaction duration. Though attempts were made to ensure these interactions were similar in duration, the average interaction duration differed across conditions (High Interpersonal, Low Epistemic: \( M = 2.96 \) minutes, \( SD = 1.01 \); High Epistemic, Low Interpersonal: \( M = 2.41 \) minutes, \( SD = 0.46 \); \( t(36) = 2.57, p = 0.01 \)). Despite this, preliminary analyses found no effect of interaction duration on any of the dependent measures. The full script for each condition can be found in Appendix 1.

**Teaching Modules.** Each child participant was taught a set of facts about a novel animal and how to use a new object. The order of presentation of these was counterbalanced across participants and conditions. The animal instruction and object demonstration did not differ across conditions. This was done in order to ensure that memory for the information was not attributable to differences in the type of animal or type of object used in the demonstration. Each is described in detail below.
**Novel Animal Instruction.** The teacher produced a laminated image of a novel animal and told the child a series of facts about the animal. The animal was selected based on its unique name and appearance. No child indicated prior knowledge of or familiarity with this animal. The facts contained no perceptually available features of the animal in order to reduce children’s ability to independently confirm the truth of the facts or to more easily recall the information at test. Across both conditions, the teacher stated the following seven facts:

1. This is a kinkajous.
2. Kinkajous live in the rainforest.
3. Kinkajous like to eat nectar.
4. Kinkajous are nocturnal, which means they sleep during the day.
5. Kinkajous are pollinators, which means they help plants grow.
6. Kinkajous can turn their feet around to walk backwards.
7. Kinkajous are sometimes called honey bears.

**Object Demonstration.** The teacher produced a peg toy apparatus and three different colored pegs (e.g. Lyons, Young & Keil, 2007; Nielsen, 2006). Across both conditions, the teacher demonstrated how to place the pegs on the apparatus using a combination of instrumental and non-instrumental actions. These were chosen given recent work showing that children overimitate agents whom they have more social regard for (Over & Carpenter, 2012). Thus, it was possible that children would more closely imitate the teacher that they found more interpersonally trustworthy. The actions were the following:

1. Touch RED object to nose
2. Place RED object in hole on bottom right
3. Rub left arm with YELLOW object
4. Place YELLOW object in hole on bottom left
5. Place GREEN on top of head
6. Place GREEN in center
Memory Assessments. Following the teaching phase, the adult teacher left the room and a neutral experimenter entered. The experimenter sat next to the child and began the assessment phase of the study with the short-term memory recall assessment. The long-term memory recall assessment was administered approximately 15 minutes later after the child completed the trust evaluation assessment, selective trust, resource allocation, and EJT trials, and the working memory task. The short- and long-term assessments were identical. They were matched to the order in which the information was presented. For example, children who received the exotic animal instruction first and object demonstration second during the teaching phase were questioned about these in the same order. Scores were calculated for each memory assessment (short term, long term) as well as for each task (animal instruction, object demonstration). The questions are detailed below.

Novel Animal Instruction Assessment: E produced the laminated picture of the animal and told the child, “Remember this animal? I’m going to ask you some questions about it.” E then asked the following open-ended questions (consistent across condition) and recorded the child’s responses.

1. What is this animal called/what is its name?
2. Where does it live?
3. What does it like to eat?
4. This animal is nocturnal. What does nocturnal mean?
5. This animal is a pollinator. What does pollinate mean?
6. What does this animal do with its feet?
7. What is it sometimes called?

Object Demonstration Assessment: E produced the peg apparatus and the different colored pegs and placed them in front of the child. E stated, “Remember this?
Can you show me how to use it?” E recorded the actions that the child did. Research assistants independently viewed the video and coded the child's responses.

**Trust Evaluations.** The trust evaluation assessment was administered after the short-term memory assessment. E produced a picture of the adult teacher the child had interacted with and stated, “Remember her? I’m going to ask you some questions about her.” Children who claimed not to know the adult were reminded that this person had just been in the room teaching them. After confirming that the child recalled this individual, E asked the child to respond to the epistemic and interpersonal trust questions. The questions were given in alternating order (e.g. epistemic question, interpersonal question). Whether the epistemic or interpersonal question was asked first was counterbalanced across participants.

**Epistemic Trust.** To evaluate how much children trusted the teacher to have knowledge about certain topics, they were asked to respond to 10 yes-no questions assessing domains of knowledge and expertise. Questions were drawn from existing work in the trust in testimony literature (Lutz & Keil, 2002).

**Interpersonal Trust.** To evaluate how much children trust each agent to help them or fulfill commitments, they were asked to respond to 10 yes-no questions assessing prosociality and benevolence. Questions were drawn from existing work in the trust in testimony literature that examine children’s moral judgments (Johnston, Landrum, Mills, 2013) and benevolence judgments (Rowles & Mills, 2018) about agents. Sample questions are included in Table 1 below. The full set of questions can be found in Appendix 2.
Table 1. Sample trust evaluation questions

**Epistemic Trust:**

1. Some people know a lot about new animals and some people do not. Does your teacher know a lot about new animals?
2. Some people know a lot about food at the grocery store and some people do not. Does your teacher know a lot about food at the grocery store?
3. Some people know a lot about why plants need sunlight to grow, and some people do not. Does your teacher know a lot about why plants need sunlight to grow?
4. Some people know a lot about why apples are sweet, and some people do not. Does your teacher know a lot about why apples are sweet?

**Interpersonal Trust:**

1. Some people keep every promise they make, and some people do not. Does your teacher keep their promises?
2. Some people follow through with what they say they will do, like giving out stickers, and some people do not. Does your teacher follow through with what she/he says they will do?
3. Some people are really good at listening to others, and some people are not. Does your teacher listen to others?
4. Some people help others when they need help, and some people do not. Does your teacher help others?

**Selective Trust, Resource Allocation, and Explicit Judgments.** Immediately after the trust assessment, E administered the selective trust, sharing, and explicit judgment trial (EJT) tasks. These tasks were always administered in the same order (described in detail below). The assessment form can be found in Appendix 3.

Selective Trust. Children’s extensions of epistemic trust have been historically assessed using the selective trust paradigm (Koenig & Harris, 2005; Koenig, Clement, & Harris, 2004). In this task, children are given information about two agents and are then asked to make selective learning decisions by asking and endorsing one of the agents’ claims about novel object/animal names. To account for the use of a single agent in the current project, an adapted version of this task was administered (Jaswal, 2004). Children
were shown an image of a hybrid object or animal, designed to look like one of two things (e.g., a ball or a button; a dog or a cat), and asked what they thought it was. Children were then told that their teacher thought it the opposite of what they said, for example: “You [child] think it’s a ball and your teacher says it’s a button. Which one is it, a ball or a button?” For each trial, children received a score of 1 if they changed their initial response to match the adult’s or a score of 0 if they continued to endorse their claim. The first two trials (50/50 hybrid) were administered after the first set of resource allocation trials, and the second two trials (75/25 hybrid) were administered after the second set of resource allocation trials.

**Resource Allocation.** The resource allocation task involved sharing stickers. This task was originally developed by Moore (2009), who found that preschoolers’ sharing decisions depended on the target (peer, parent, stranger). Children were shown an image of the adult teacher and presented with two types of allocation decisions: prosocial and sharing. On Prosocial Trials (3 trials) children were told, “You can have one sticker for yourself now or one for your teacher and one for you later. What would you like to do?” On Sharing Trials (3 trials), children were told, “You can have two stickers for yourself now or one for your teacher and one for you later. What would you like to do?” A score was calculated by summing the number of times children chose to be prosocial or share divided by the total number of trials, yielding a proportion from 0 to 1 with scores closer to 1 representing higher rates of sharing. The first two trials were administered after the first set of EJT questions, the second set of trials after the second set of EJT questions, and the third set after the third set of EJT questions.
Explicit Judgment Questions. To assess children’s explicit judgments about the teacher, they were asked *Is your teacher very smart?* and *Is your teacher very nice?* Each question was asked three times. The questions were always asked in the same order. The questions were asked after the trust evaluation assessment, after the first set of selective learning trials, and after the second set of selective learning trials.

Executive Function. Experimental work with preschoolers has found that individual differences in executive function can impact how children evaluate claims. For example, while four-year-old children demonstrated skepticism toward teachers with a brief history of inconsistent statements, this was best predicted by executive function and working memory (Doebel, Rowell & Koenig, 2016). Moreover, a growing body of work suggests that EF skills are important indicators of academic achievement (Brock et al., 2009). Thus, to ensure that children in our project are not simply better able to remember information due to their EF abilities - abilities to inhibit responses, listen to teachers and remember information - EF was measured and included as a covariate in all analyses. In the present study, forward and backward working memory was assessed using a word span task. In this task, children are asked to repeat a series of words back to the experimenter (forward or backward). The span is increased with each success until the child makes three consecutive failures. Each child received two scores - one for forward span and a second for backward span - that indicated the highest level passed (i.e. the largest sequence of words successfully repeated forward/backward).

Results

All analyses were conducted in R Studio (R Core Team, 2014). The primary questions of interest include how trust evaluations differ based on teacher behavior and
the extent to which the trust evaluations are related to each other and to learning and memory.

**Epistemic and Interpersonal Trust Evaluations.** A composite score was calculated for each trust evaluation type by averaging across the 10-items. Higher scores (closer to 1) indicate greater epistemic and interpersonal trust in the agent. Separate multiple regression analyses were run to examine whether age or condition could significantly predict children’s epistemic and interpersonal trust.

First, epistemic trust was examined. The best fitting model included age and condition as predictors, but not their interaction. The model explained 5% of the variance, and was marginally significant in predicting epistemic trust, $F(2,60) = 2.81, p = 0.06$. Condition was a significant predictor of variation in epistemic trust ($\beta = -0.05, p = 0.05$), while age was not ($\beta = 0.03, p = 0.20$). Specifically, children’s epistemic trust in the agent was lower in the High Interpersonal, Low Epistemic ($M = 0.79, SD = 0.30$) condition compared to the High Epistemic, Low Interpersonal condition ($M = 0.91, SD = 0.15$), $t(45) = -1.97, p = 0.05$.

Second, interpersonal trust was examined. The best fitting model included age and condition as predictors, but not their interaction. The model explained only 1% of the variance, and was not significant in predicting interpersonal trust, $F(2,60) = 0.49, p = 0.61$. Neither condition ($\beta = -0.02, p = 0.32$) nor age ($\beta = 0.001, p = 0.95$) was a significant predictor of variation in interpersonal trust. Three-year-olds ($M = 0.85, SD = 0.28$) and 4-year-olds ($M = 0.82, SD = 0.27$) reported high levels of interpersonal trust in the High Interpersonal, Low Epistemic condition. Similarly, 3-year-olds ($M = 0.88, SD = 0.27$) and 4-year-olds ($M = 0.82, SD = 0.27$) reported high levels of interpersonal trust in the High Interpersonal, Low Epistemic condition.
and 4-year-olds ($M = 0.90, SD = 0.13$) also reported high levels of interpersonal trust in the High Interpersonal, Low Epistemic condition.

![Bar chart showing average trust score by condition and age group.]

*Fig 1. Average score for each trust type by condition and age group*

**Selective Trust, Resource Allocation, and Explicit Judgments.**

**Selective Trust.** For each trial, participants received a score of 0 if they did not change their initial classification judgment to match the adult’s or 1 if they did. To explore children’s deference to the adult’s label, a mixed effects logistic regression was conducted with deference score (0: did not defer, 1: deferred) as the outcome variable. Condition, age (months), and hybrid type (50/50 vs. 75/25) were entered as predictors. Participant intercept was allowed to vary to account for repeated responses. There was a significant main effect of age, with 3-year-olds ($M = 0.25, SD = 0.43$) deferring less than 4-year-olds ($M = 0.46, SD = 0.50$), ($β = -1.20, SE = 0.54, p < 0.05$). There was also a significant main effect of condition, with more deference in the High Interpersonal, Low Epistemic condition ($M = 0.45, SD = 0.50$) than in the High Epistemic, Low Interpersonal condition ($M = 0.29, SD = 0.45$), ($β = 1.13, SE = 0.55, p < 0.05$). Finally, there was a
significant interaction between condition and hybrid type ($\beta = 0.71, SE = 0.25, \chi^2(4) = 12.99, p < 0.05$). Children were more likely to defer on 50/50 hybrid trials in the High Interpersonal, Low Epistemic condition, whereas there was more deference on 75/25 trials in the High Epistemic, Low Interpersonal condition (see Figs 2 and 3).

**Fig 2. Average deference score by hybrid trial type, age, and condition**

**Resource Allocation.** Preliminary analyses indicated that there were no significant differences across trials on prosocial or sharing tasks. A score was calculated for each type of allocation task (prosocial, sharing) by summing the number of times (out of 3) that children chose to give resources to the agent. A mixed effects linear regression model was conducted with score as the dependent variable. Condition, age (year), and task type (prosocial vs. sharing) and their interactions were entered as predictors. Participant intercept was allowed to vary to account for repeated responses on task type. There were no significant differences between the full model including interactions and the model without interactions, $\chi^2(4) = 4.36, p = 0.35$. The results of the reduced model are reported here. There was a significant main effect of condition, children in the High
Interpersonal, Low Epistemic condition ($M = 1.12, SD = 1.15$) allocated less resources to the agent than those in the High Epistemic, Low Interpersonal condition ($M = 1.68, SD = 1.19$), ($\beta = -0.29, SE = 0.13, p < 0.05$). There were no other significant effects ($p$’s = ns). These results are shown in Fig 4.

![Fig 3. Average allocation score by trial type, age, and condition](image)

**Explicit Judgment.** Preliminary analyses indicated that there were no significant differences across the three trials on smart (“Is she very smart?”) or nice (“Is she very nice?”) questions. A score was calculated for each type of EJT question (smart, nice) by summing the number of times (out of 3) that children indicated that the agent was very smart or very nice. A mixed effects linear regression model was conducted with EJT score (range: 0 to 3) as the dependent variable. Condition, age (year), and question type (smart vs. nice) and their interactions were entered as predictors. Participant intercept was allowed to vary to account for repeated responses on question type. The model with the interactions was not significantly different from the one without interactions ($\chi^2(4) = 2.26, p = 0.68$). The model without interaction effects is reported here. There was a
significant main effect of age, with 3-year-olds ($M = 2.67, SD = 0.70$) less likely to judge the agent as smart or nice than 4-year-olds ($M = 2.89, SD = 0.35$), ($\beta = -0.11, SE = 0.05, p < 0.05$). There were no other significant effects.

**Working Memory.** Each child received two scores: one for their forward word span and the second for their backward word span. The scores indicate the child’s highest level passed on each assessment type, which ranged from 1 to 5. A linear mixed effects model was conducted with score as the outcome and age (months), condition, and span type (forward vs. backward) entered as predictors. Participant intercept was allowed to vary given repeated responses on span type. There was a significant main effect of age ($\beta = 0.07, SE = 0.01, p < 0.001$), suggesting that children had higher span lengths with age. There was also a significant main effect of span type ($\beta = 2.09, SE = 0.11, p < 0.0001$), with higher forward span ($M = 3.66, SD = 0.87$) than backward span ($M = 1.56, SD = 0.76$). These findings are consistent with the literature on working memory with preschoolers.

**Short- and Long-Term Memory Recall.**

**Novel Animal Facts.** Children responded to 7 questions assessing their recall of the novel animal facts taught to them. Table 2 shows the average number of correct responses for each question by condition for the short-term and long-term recall assessments. A score was calculated for each recall assessment by summing the number of correct responses (out of 7). A linear mixed effects model was conducted with score (Range: 0 to 7) as the dependent variable. Condition, age, and assessment type (short term vs. long term) and their interactions were entered as predictors. Participant intercept was allowed to vary to account for repeated responses on assessment type. There was a
significant main effect of Age, with 3-year-olds ($M = 1.34, SD = 1.43$) recalling less facts than 4-year-olds ($M = 2.76, SD = 1.51$), ($\beta = -0.70, SE = 0.17, p < 0.001$). In addition, there was a significant main effect of assessment type, with more facts recalled on the short-term assessment ($M = 2.25, SD = 1.62$) than the long-term assessment ($M = 1.97, SD = 1.65$), ($\beta = -0.14, SE = 0.04, p < 0.01$). These results are depicted in Fig. 5 below.

Table 2. Novel Animal Facts: Average number of correct responses on each short- and long-term recall question by condition.

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Object Demonstration. Children were given the object and asked to show E how to use it. There were 6 demonstrated actions by the adult teacher. Three were instrumental (pegs in holes) and three were non-instrumental (pegs touch nose/head/arm). Table 3 shows the average number of correct responses (out of 3) for each type of action (instrumental vs. non-instrumental) by condition for the short-term and long-term assessments. A score was calculated for each recall assessment by summing the number of correct instrumental and non-instrumental actions copied (each out of 3). A linear mixed effects model was conducted with score (Range: 0 to 3) as the dependent variable. Condition, age, action type (instrumental, non-instrumental) and assessment type (short term vs. long term) and their interactions were entered as predictors. Participant intercept was allowed to vary to account for repeated responses on assessment type. There was a significant main effect of action type, with more correct copying of instrumental ($M = 0.84, SD = 1.01$) than non-instrumental actions ($M = 0.58, SD = 0.94$), ($t = 0.13, SE = 0.05, p < 0.01$). There was also a significant main effect of assessment type, with less
correct copying on the long-term assessment ($M = 0.61, SD = 0.94$) than on the short-term assessment ($M = 0.80, SD = 1.02$), ($\beta = -0.11, SE = 0.05, p < 0.05$). Finally, there was a significant interaction between age and assessment type ($\beta = -0.16, SE = 0.05, \chi^2(11) = 20.834, p < 0.05$). Three-year-olds were less likely to recall how to use the object on the long-term assessment compared to the short-term assessment, whereas 4-year-olds showed the opposite pattern (see Fig 6).

Table 3. Object Demonstration: Average number of correct responses on each short- and long-term recall question by condition.

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</tbody>
</table>
Predictors of learning. One of the aims of this study was to examine whether relationships exist between children’s epistemic trust or interpersonal trust and their learning, as measured by the short- and long-term memory assessments. Four hierarchical linear regression models were conducted for each memory assessment (short term, long term) and each topic (animal facts, object demonstration). Score was entered as the outcome variable with condition, age (year), working memory score (forward, backward), epistemic trust, interpersonal trust entered as predictors in three steps. In the first step, condition and age were entered to examine for effects of age controlling for condition. In the second step, working memory scores were entered to examine how these impacted memory recall scores controlling for condition and age. In the third step, epistemic and interpersonal trust were entered to examine whether these predictors explained any additional variance in memory recall scores controlling for condition, age, and working memory. The results are shown in Tables 4 – 7 and described below.
Novel Animal Facts: Short-Term Recall. The results are shown in Table 4. At Step 1, age accounted for significant unique variance in recall score ($\beta = 0.15, t(58) = 3.48, p = 0.001$). The overall Step 1 model was significant ($F(2,58) = 6.17, p = 0.003$) and accounted for 14% of the variance in recall score. Step 2 examined the contribution of working memory by including forward and backward word span scores. After controlling for condition and age, working memory marginally improved the model ($\Delta R^2 = 0.06, F(2) = 2.93, p = 0.06, R^2 = 0.20$). Specifically, backward working memory score was a significant predictor of recall score above and beyond condition and age ($\beta = 0.57, t(56) = 2.04, p = 0.04$). Step 3 examined the contribution of trust by including epistemic and interpersonal trust scores. Trust did not explain additional variance in recall score ($F(2) = 0.13, p = ns$).

Table 4. Summary of hierarchical regression model for analysis of the relationship between short term animal fact score, condition, age, working memory, and trust

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Step 1 Estimates</th>
<th>Confidence Interval (95%)</th>
<th>P-Value</th>
<th>Step 2 Estimates</th>
<th>Confidence Interval (95%)</th>
<th>P-Value</th>
<th>Step 3 Estimates</th>
<th>Confidence Interval (95%)</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>-4.51</td>
<td>-8.92 to -0.10</td>
<td>0.045</td>
<td>-3.46</td>
<td>-7.83 to -0.92</td>
<td>0.119</td>
<td>-3.22</td>
<td>-7.94 to 1.50</td>
<td>0.177</td>
</tr>
<tr>
<td>Condition (High I, Low E)</td>
<td>-0.47</td>
<td>-1.25 to 0.32</td>
<td>0.236</td>
<td>-0.62</td>
<td>-1.40 to -0.16</td>
<td>0.115</td>
<td>-0.64</td>
<td>-1.46 to -0.19</td>
<td>0.128</td>
</tr>
<tr>
<td>Age (months)</td>
<td>0.15</td>
<td>0.06 to 0.24</td>
<td>0.002</td>
<td>0.09</td>
<td>-0.01 to -0.19</td>
<td>0.070</td>
<td>0.09</td>
<td>-0.01 to -0.19</td>
<td>0.081</td>
</tr>
<tr>
<td>Forward Word Span</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Backward Word Span</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Epistemic Trust</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interpersonal Trust</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Observations</td>
<td>61</td>
<td></td>
<td></td>
<td>61</td>
<td></td>
<td></td>
<td>61</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$R^2 / R^2$ adjusted</td>
<td>0.176 / 0.147</td>
<td></td>
<td></td>
<td>0.256 / 0.203</td>
<td></td>
<td></td>
<td>0.260 / 0.177</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Novel Animal Facts: Long-Term Recall. The results are shown in Table 5. At Step 1, age accounted for significant unique variance in recall score ($\beta = 0.13, t(58) = 2.87, p = 0.005$). The overall Step 1 model was significant ($F(2,58) = 4.62, p = 0.01$) and accounted for 11% of the variance in recall score. Step 2 examined the contribution of working memory by including forward and backward word span scores. After controlling
for condition and age, working memory significantly improved the model ($\Delta R^2 = 0.06$, $F(2) = 3.13, p = 0.05, R^2 = 0.17$). Specifically, backward working memory score was a significant predictor of recall score above and beyond condition and age ($\beta = 0.61, t(56) = 2.17, p = 0.03$). Step 3 examined the contribution of trust by including epistemic and interpersonal trust scores. Trust did not explain additional variance in recall score ($F(2) = 0.24, p = ns$).

Table 5. Summary of hierarchical regression model for analysis of the relationship between long term animal fact score, condition, age, working memory, and trust

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Step 1</th>
<th>Step 2</th>
<th>Step 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Estimates Conf. Int (95%) P. Value</td>
<td>Estimates Conf. Int (95%) P. Value</td>
<td>Estimates Conf. Int (95%) P. Value</td>
</tr>
<tr>
<td>Intercept</td>
<td>-4.13 -8.58 – 0.32</td>
<td>0.068 -3.01 -7.41 – 1.38</td>
<td>0.175 -2.66 -7.39 – 2.08</td>
</tr>
<tr>
<td>Condition (High I, Low E)</td>
<td>-0.34 -1.13 – 0.46</td>
<td>0.400 -0.49 -1.27 – 0.30</td>
<td>0.218 -0.40 -1.23 – 0.43</td>
</tr>
<tr>
<td>Age (months)</td>
<td>0.13 0.04 – 0.22</td>
<td>0.006 0.07 -0.02 – 0.17</td>
<td>0.138 0.07 -0.03 – 0.17</td>
</tr>
<tr>
<td>Forward Word Span</td>
<td>0.19 -0.32 – 0.69</td>
<td>0.457 0.17 -0.38 – 0.71</td>
<td>0.542</td>
</tr>
<tr>
<td>Backward Word Span</td>
<td>0.61 0.05 – 1.17</td>
<td>0.034 0.60 0.02 – 1.17</td>
<td>0.487</td>
</tr>
<tr>
<td>Epistemic Trust</td>
<td>-0.87 -3.37 – 1.63</td>
<td>0.487</td>
<td></td>
</tr>
<tr>
<td>Interpersonal Trust</td>
<td>0.66 -2.04 – 3.36</td>
<td>0.627</td>
<td></td>
</tr>
</tbody>
</table>

Object Demonstration: Short-Term Recall. The results are shown in Table 6. At Step 1, neither condition nor age accounted for significant unique variance in recall score. The overall Step 1 model was not significant ($F(2,48) = 0.71, p = ns$) and accounted for 0% of the variance in the overall demonstration recall score. Step 2 examined the contribution of working memory by including forward and backward word span scores. Working memory did not explain variance in recall score ($F(2) = 1.45, p = ns$). Step 3 examined the contribution of trust by including epistemic and interpersonal trust scores. Trust did not explain additional variance in recall score ($F(2) = 0.32, p = ns$).
Object Demonstration: Long-Term Recall. The results are shown in Table 7. At Step 1, age accounted for significant unique variance in recall score ($\beta = 0.15$, $t(46) = 2.73$, $p = 0.008$). The overall Step 1 model was significant ($F(2,46) = 5.21$, $p = 0.009$) and accounted for 15% of the variance in recall score. Step 2 examined the contribution of working memory by including forward and backward word span scores. Working memory did not explain variance in recall score ($F(2) = 1.54$, $p = ns$). Step 3 examined the contribution of trust by including epistemic and interpersonal trust scores. Trust did not explain additional variance in recall score ($F(2) = 0.45$, $p = ns$).
Discussion

In the present study, a naturalistic learning opportunity was presented to children. All children learned new information, including facts about a novel animal and how to use a new object. The way the information was delivered differed as a function of condition. Half of the children were taught by an agent who was high in interpersonal qualities, but low in epistemic qualities, while the other half were taught by an agent who was high in epistemic qualities, but low in interpersonal qualities. Instead of using traditional ask and endorse questions to assess learning preferences, children’s learning was assessed by assessing how well they remembered the information that was taught to them. To measure trust, novel assessments were created that asked children to rate how epistemically and interpersonally trustworthy they felt the agent was across 20 yes-no questions (10 for each type of trust). Children were then given opportunities to decide whether to defer to the judgment of the agent regarding the identity of hybrid object/animal pictures, whether to allocate resources to the agent, and to indicate whether they felt the agent was smart and nice. Finally, children’s working memory was assessed and included as a covariate in analyses examining the relationship between learning and epistemic and interpersonal trust.

Of interest was whether children’s epistemic and interpersonal evaluations of the agent would differ as a function of condition. It was expected that the condition manipulation would result in lower epistemic trust in the High Interpersonal, Low Epistemic agent, but higher interpersonal trust in this agent compared to those in the High Epistemic, Low Interpersonal condition. In line with this expectation, epistemic trust ratings were higher for the High Epistemic, Low Interpersonal agent than the High
Interpersonal, Low Epistemic agent. In contrast, interpersonal ratings did not differ across conditions, with children giving high interpersonal trust ratings for both agents. Interestingly, condition differences emerged on other measures in which children were asked to make epistemic-type and interpersonal-type evaluations. In the selective learning task, children were given four opportunities to defer to the judgment of the adult teacher about the identity of hybrid pictures of objects and animals. Two trials were 50/50 hybrids, in which the object or animal depicted was equally likely to be either label (e.g. 50% squirrel, 50% rabbit). The other two trials were 75/25 hybrids, in which the object or animal depicted looked more like one of the labels (e.g. 75% cat, 25% dog). There was a significant interaction between condition and trial type, with children significantly more likely to change their initial response to the label provided by the adult teacher in the High Interpersonal, Low Epistemic condition, especially on 50/50 hybrid pictures. In contrast, while those in the High Epistemic, Low Interpersonal condition were overall less likely to defer, they showed slightly higher deference on 75/25 hybrid pictures. One possibility for this is that deference on the 75/25 trials required more epistemic trust in the agent in order to override the label endorsed by the child, which was higher in this condition.

A different pattern emerged on resource allocation trials. Despite showing higher deference for labels in the High Interpersonal, Low Epistemic condition, children in this condition were less likely to allocate resources (stickers) to the adult in this condition compared to those in the High Epistemic, Low Interpersonal condition. Combined with their high interpersonal trust ratings, it appears that children in the High Epistemic, Low Interpersonal condition found this adult to be interpersonally trustworthy - to the extent
that these measures assess interpersonal or affiliative evaluations of agents. One reason for this might be that children were sensitive to the adult’s calibration - a trait that has been found to be important to children at this age (Suárez, 2019). Specifically, the adult teacher made clear that she knew information and then provided it, as promised. Though the agent in the High Interpersonal, Low Epistemic condition was more engaged with the child, she made claims about her lack of knowledge but then proceeded to provide it. This discontinuity could have been viewed by children as deceptive or misleading.

But, the significant condition difference on selective learning trials in which children showed more deference to the adult in the High Interpersonal, Low Epistemic condition suggests that children indeed viewed this adult as worth learning from. One question is whether deference on these learning trials showcases epistemic trust, in a way that the 10-item epistemic trust assessment did not assess. It is possible that asking children to rate how knowledgeable they viewed the adult to be across different topics and scenarios was more akin to a set of explicit judgment questions, or a more straightforward assessment of the epistemic qualities of agents. Indeed, children have been shown to be more proficient at identifying which of two agents is a better source of information on explicit judgment questions, but then go on to be closer to chance in their endorsement of that agent’s information (Koenig & Harris, 2005). Here, it may be that while children were good at judging the epistemic quality of the adult, their behavior, as assessed by their deference on hybrid classification trials, is a better metric of epistemic trust. If this were true, then children’s higher rates of deference in the High Interpersonal, Low Epistemic condition might indicate that interpersonal components in teaching are
important to children and used to guide certain types of learning decisions (e.g. what to believe).

What about learning and memory, as assessed in this study? Children’s short- and long-term recall of the information taught to them did not differ across the two conditions. There were significant differences based on age and assessment type. Specifically, 3-year-olds recalled less than 4-year-olds and overall, children recalled more on the short-term assessment than the long-term assessment. HLM was used to assess predictors of these scores, above and beyond age and assessment type. Backward word span was a significant predictor of learning and memory for both novel animal facts as well as object demonstration. Neither epistemic trust nor interpersonal trust emerged as significantly associated with learning and memory on these measures. Indeed, executive functioning has been found to be an important indicator of child academic achievement (Diamond, 2012) and it is not surprising that in the current study, EF was strongly related to performance on the recall assessments.

Nonetheless, work in educational psychology has shown that teacher-student relationships are important for child academic success as well (Pianta & Stuhlman, 2004). But, there have been no documented attempts to understand how EF and trust - a potential measure of teacher-student relationship quality - are related to learning outcomes in early childhood. The current study attempted to begin addressing this issue. Though child evaluations of epistemic and interpersonal trust were not associated with learning and memory, this finding can be interpreted in a few ways. One possibility is that the assessments of epistemic and interpersonal trust failed to capture the underlying latent constructs that they were designed to assess. Though both assessments had high
internal consistency, it may be that they functioned for children as more explicit judgment type questions and less about trust in the adult. Another possibility is that the use of yes-no questions on the trust assessments was either confusing to children at this age, or resulted in less variation in responses. Use of a Likert Scale question could mitigate this worry. Another possibility is that these assessments did capture the underlying latent constructs of epistemic and interpersonal trust, but that the interaction the child had with the adult was not sufficient to allow for a meaningful level of trust to develop. Though attempts were made to create natural interactions, scripts were used to ensure children had reliably consistent information about the agent and the information taught to examine for effects of condition on responses. Moreover, the interactions averaged to 3-minutes, which may not have been enough time for children to develop a strong sense of trust in the adult. Another possibility is that trust was not related to learning, as measured in this study. Open-ended questions were used to avoid ceiling effects, but it may be that the open-ended questions were difficult and required more advanced cognitive skills (e.g. in working memory) for success. Future work will investigate other ways of assessing learning.

This study offers initial evidence that preschoolers’ trust can be flexibly extended after a natural interaction using novel assessments of epistemic and interpersonal trust. Children’s inferences were based only on what the adult said to them during the brief interaction, and not on any explicit information stated by an experimenter about the epistemic or interpersonal status of the adult. This suggests that by the preschool years, children are attending to the epistemic quality in their interactions with others and use this information to inform their evaluations about adults around them. While
interpersonal trust did not differ as a function of condition in the current study, it is likely that children are attending to these cues as well, but that the manipulation was not strong enough to reduce interpersonal trust. Though neither form of trust was found to be related to learning here, future work will be needed to better understand how trust impacts children’s learning by using different ways of measuring learning, or by examining the role that trust plays in other behaviors that could impact learning.
Study 2: Measuring preschoolers’ epistemic and interpersonal trust in the classroom - a quasi-longitudinal exploration of trust and its impact on learning.

Introduction

While abundant work has documented children’s selective social learning in experimental settings, much of what children learn on a day-to-day basis comes from parents, teachers, and peers with whom they share a community with (Pesch, Suárez, & Koenig, 2018). In experimental settings, we know that by the preschool years, children show sophisticated capabilities to distinguish between agents who differ along various sociomoral and epistemic dimensions, preferring to learn from agents who are more positive (for a review see Harris et al., 2018, Mills, 2013). Many scholars have conceptualized children’s ability to display selective social learning as reflecting evidential or rational decisions made in light of evidence about how epistemically trustworthy an agent has shown themselves to be (Sobel & Kushnir, 2013). However, evidential models may not fully capture the interpersonal or social dynamics that feature in children’s extensions of trust. While relevant evidence can be a reliable cue of an agent’s epistemic trustworthiness, testimonial learning inextricably involves joint interactions as information is transmitted between a speaker and a hearer (McMyler, 2011). Given this, it is important to consider not only the evidential cues that children reason about when they are learning from others, but also the interpersonal cues that may also play an important role in their learning decisions.

Much less work has directly investigated how the interpersonal components embedded within testimonial learning opportunities impact children’s learning. In one study, Rowles and Mills (2018) found that children were more likely to seek out help
from a socially engaged, but incompetent agent when tasked with completing a difficult puzzle, suggesting that in certain contexts, interpersonal cues play an important role in children’s learning. This study involved children seeking out help, a decision which may have pulled more at children’s interpersonal evaluations than epistemic evaluations or goals. Competing epistemic and interpersonal cues in the context of a more classic selective learning decision was investigated in two studies by Corriveau and colleagues (2009a; 2009). In the first, Corriveau et al. (2009) examined preschoolers’ learning from their mother versus a stranger, and the degree to which individual differences in attachment security moderated learning. Children’s pattern of learning depended on their attachment status, with secure children flexibly learning from their mother or a stranger depending on which favored the perceptual cues of a hybrid animal picture. Differently, insecure-resistant children preferred their mother’s claims even when the perceptual cues favored the stranger’s claims, and insecure-avoidant children preferred the stranger’s claims even when the perceptual cues favored their mother’s claims. In another study, Corriveau and Harris (2009) investigated 3- to 5-year-old children’s learning from a familiar versus an unfamiliar school teacher. Preschoolers showed robust preferences to ask and endorse information from the familiar teacher, but this preference was moderated for 4- and 5-year-olds by information about their teacher’s epistemic status. Specifically, when the familiar teacher was later shown to label familiar objects incorrectly, 4- and 5-year-olds’ preferences to ask and endorse information from her about novel object labels was reduced. Together, these studies highlight that social cues and developing relationships impact how children respond to learning opportunities.
A large gap remains in our understanding how children’s selective learning plays out in naturalistic, applied settings. How do repeated interactions filled with information about epistemic and interpersonal indicators of trustworthiness impact children’s learning? Work in the lab suggests that at least by 4-years, children take into account a single agent’s history of accuracy and update their trust in them according to how accurate (or inaccurate) they have been in the past (Ronfard & Lane, 2018). In this study, 4- to 7-year-old children were introduced to an agent who made claims about the location of a hidden object on four occasions. Depending on the condition, the agent made one inaccurate claim that occurred either on the 1st, 2nd, or 3rd trial. Although trust was reduced when the agent displayed inaccuracy on the 1st or 2nd trial, it was regained after subsequent accurate claims (Ronfard & Lane, 2018). While this study offers initial evidence that preschool-aged children monitor adults around them for epistemic quality, and adjust their epistemic trust according to an agent’s history of accuracy, it is still unclear how this functions in natural settings.

One place to examine this is in educational settings, where we know that trust has important implications for academic achievement (Goddard et al., 2009). Trust has been shown to have an important impact upon how students relate to teachers, with student-teacher relationship quality serving as a catalyst for academic achievement (Lerner, 1998; Rimm-Kaufman & Pianta, 2000; Teo et al., 1996). Research in educational psychology shows that general assessments of trust, especially for students from diverse and underserved backgrounds, relate to academic achievement (Goddard, Salloum, Berebitsky, 2009), school adjustment (Betts & Rotenberg, 2008), teacher-student relationship quality (O'Connor, Cappella, & McClowry, 2013), and acceptance of
criticism and praise for school work (Yeager et al., 2013). Student-teacher relationship quality is also known to relate to positive academic and social outcomes (Pianta, 1992; Hughes & Kwok, 2007). Increasingly, work has shown that factors like advanced education or training are not sufficient to explain variation in teacher quality (Corriveau & Winters, 2019). Models which target teacher-child interactions, however, have found measurable differences in both teacher quality and student academic achievement (Allen et al., 2011).

This body of work points to an important, but historically neglected, mechanism that may be facilitating student academic achievement and learning by promoting more positive student-teacher interactions: trust. Despite work showing the importance of general notions of trust in educational contexts, there is little research directly investigating students’ trust in their teachers, and very little work that has asked how student trust impacts learning. The few studies that have examined students’ trust in teachers focus on middle school and high school students and define trust in terms of general views about the trustworthiness of school and community (Yeager et al., 2013; Romero, 2015). For example, surveys of student trust are typically general and not tailored to a specific individual (e.g. “I am treated fairly by teachers and other adults at my school,” Yeager et al., 2013), which leaves unanswered important questions about any given student’s trust in their specific teachers, and in the specific epistemic and social characteristics of teachers that cultivate trust. Moreover, while interventions (e.g. Allen et al., 2011) have shown that targeted feedback given to teachers can improve their interactions with students, it remains unclear what factors students find important in these interactions. Moreover, in early elementary classrooms, little is known about how
students assess the trustworthiness of their teachers, nor how specific types of trust in their teachers contributes to academic achievements (Denton, 2013).

The current project was an initial attempt to examine these questions in a preschool-aged sample of students. This age group was targeted given abundant experimental work in developmental psychology identifying a role for epistemic trust in preschoolers’ testimonial learning decisions (Koenig, Clement & Harris, 2004), their information-seeking (Begus & Southgate, 2012), their predictions of other’s learning (Jeong & Frye, 2018), inductive generalization (Butler & Tomasello, 2016), their vigilance toward text (Eyden, Robinson, Einav and Jaswal, 2013) and their source memory (Corriveau & Harris, 2008). This work makes clear that by the preschool years, children actively evaluate sources who communicate information to them, and selectively trust those who reduce risks for misinformation. This work suggests that children’s epistemic trusting decisions are based on knowledge assessments, and are often based in a kind of probabilistic inference that is continually adjusted based on the available evidence about an agent’s knowledge in different domains (Shafto, Eaves, Navarro & Perfors, 2012; Sobel & Kushnir, 2013).

Relationships, however, are built on more than knowledge-based assessments. And indeed, there is work that has identified a role for interpersonal or social characteristics in preschoolers’ willingness to delay gratification (Kidd, Palmieri & Aslin, 2013; Michaelson & Munakata, 2016; Pesch & Koenig, 2018), to choose cooperative partners (Dunfield, Kuhlmeier & Murphy, 2013), to keep promises or secrets (Isella, Kanngiesser, & Tomasello, 2018) and their favorability ratings (Hetherington, Hendrickson, & Koenig, 2014; Pesch & Koenig, 2018). Children monitor for and
selectively prefer to learn from an individual who is a member of their social group (Corriveau, Fusaro, & Harris, 2009; Elashi & Mills, 2014; Kinzler, Corriveau & Harris, 2011; McDonald & Ma, 2016). For example, they prefer to learn from an informant who shares their racial group (Chen, Corriveau, & Harris, 2013), gender (Boseovski, Hughes, & Miller, 2016), or accent (Corriveau, Kinzler, & Harris, 2013) and wins group consensus (Corriveau, Fusaro, et al., 2009). When it comes to learning in the classroom, interpersonal reasons that children have to trust a teacher (e.g. group membership, familiarity) may impact their willingness to learn from certain teachers. For example, a recent study found that while 3- to 6-year-old children had equal levels of interest in STEM topics, boys preferred to learn STEM content from male media characters over female media characters (Schlesinger & Richert, 2019). In other work, young children were willing to believe a teacher’s claims about events that violated perceptual evidence about the physical world, suggesting that claims made by teachers can impact children’s learning (Jaswal, 2010). Taken together, these findings converge on the important and unexamined role that epistemic and interpersonal trust may play in early childhood education. Further, while this work has identified the important role that epistemic trust and interpersonal trust plays for children in laboratory settings, no work to date has attempted to identify how these different varieties of trust impact learning in a classroom setting.

Measuring Trust. The current project aimed to understand whether preschool-aged children’s epistemic and interpersonal trust can be measured and is subject to variation across classrooms and time. In addition, this project is one of the first attempts
to investigate whether trust serves as an important mechanism that supports positive learning outcomes in a classroom setting.

Due to limited work investigating these distinct varieties of trust, two 10-item questionnaires were developed. Drawing on literature examining children’s knowledge judgments (Lutz & Keil, 2002), moral judgments (Johnston, Landrum, Mills, 2013) and benevolence judgments (Rowles & Mills, 2018) about agents, two 10-item evaluations were created to assess children’s ratings of epistemic trust (the extent to which they viewed their teacher as having knowledge across different situations and domains) and interpersonal trust (the extent to which they viewed their teacher as a source of help or comfort across different situations). Children’s responses to these questions were compared to other measures used in the literature to assess epistemic trust (Jaswal, 2004) and interpersonal/prosocial behavior (e.g. a sharing task, Moore (2009)). These assessments were used as additional measures of interpersonal and epistemic decisions that have been more broadly used to assess children’s social and epistemic evaluations in the developmental literature. In order to assess learning, teachers were asked to lead two large group lessons (once in the Fall semester and again the Spring) about a topic that had not been introduced to the children before. Open-ended recall questions were developed after the lesson to measure children’s recall of the information taught to them.

After the large group lesson, children were individually pulled from their classroom and tested by a graduate research assistant in a quiet testing room. Children were first asked to respond to the memory recall questions about the target large group lesson. After this, an image of their teacher was produced and children were asked to respond to the two 10-item epistemic and interpersonal trust evaluation assessments.
Children were then given opportunities to allocate resources to their teacher (e.g. Moore, 2009) and to learn new information from their teacher about the identity of a hybrid object or animal (Jaswal, 2004). Finally, children’s working memory was assessed using a word span task and included as a covariate in analyses examining predictors of learning, as measured with the memory recall questions.

Method

Ethics Statement. This study was approved by the Institutional Review Board at the University of Minnesota (IRB ID: #STUDY00006095). These data were collected between November 2019 and March 2020.

Participants. The sample included 43 children (25 girls and 18 boys) and 4 lead teachers recruited across four multi-age preschool classrooms at a campus-based preschool at the University of Minnesota. The children were predominantly Caucasian, though other ethnic groups were represented in this sample. The teachers were all Caucasian and female.

During the initial discussions between a graduate research assistant and the preschool teachers and staff, the study was described as one examining how student trust in teachers impacts learning. Teachers were told that they would be filmed leading a large group lesson twice during the academic school year, but given no direct instructions regarding how to lead the lesson. Teachers were informed that the material covered should be something new to the students. Teachers were also informed that children would be asked to answer a set of memory recall questions about the lesson and to make epistemic (knowledge) and interpersonal (benevolence/prosocial) judgments about them. All teachers agreed to participate.
A request to use the lab school population for a research study was submitted to the lab school director. The current study was approved within the parameters covered by the general consent which families opt into when enrolling their child in this program. A letter detailing the procedure and a short description of the study was sent to the families of children enrolled in the multi-age classes at the preschool. Parents were given one week to opt their child out of the study. Children were then approached by a graduate research assistant during regular school hours and asked if they would like to participate. Participating children were drawn from four multi-age classrooms. Approximately 10 children from each classroom participated at Time 1 (Range: 9 - 10) and 8 children from each classroom participated at Time 2 (Range: 6 - 10). A total of 40 children agreed to participate at Time 1 (Fall 2019) and 32 agreed to participate at Time 2 (Spring 2020). The data from 5 children at Time 1 were removed due to missing data (e.g. failure to complete assessments). Of the 32 children tested at Time 2, 3 had not been tested at Time 1 and 11 declined to participate again. The average number of days between the target group lesson and the individual testing session was approximately 20 days (Range: 3 - 33 days) at Time 1 and approximately 6 days (Range: 4 - 21 days) at Time 2. Despite this difference, the cued recall score averaging across age and classroom was nearly identical at both times points (55% and 56%, respectively).

Procedure. At each time point, participating lead teachers were videotaped leading a large group lesson on a topic of their choice. Memory recall questions were developed to assess material covered in each respective lesson. After the large group lesson, children were individually pulled from class for approximately 20 minutes and assessed by a graduate research assistant. At both time points, children were asked to
respond to memory recall questions about the lesson. After the memory assessment, all children were asked to make epistemic and interpersonal trust judgments, selective learning decisions, and resource allocation decisions about their lead teacher. Finally, all children completed a word span task assessing forward and backward working memory span.

**Teaching and Memory Assessments.** Existing work assessing children’s academic outcomes have not been tailored to specific content; rather, studies examining the impact of trust on academic outcomes utilize standardized assessments of learning (e.g. Woodcock-Johnson Test of Cognitive Abilities, Woodcock, 1977) or cognitive mechanisms that support learning, like task persistence, attention, and motivation (Coolahan et al, 2000; Fantuzzo et al, 2004). The focus here was how students’ trust impacts the learning of *specific content* delivered by a *specific teacher*. To this end, teachers were free to choose the material and the way that it was administered to allow for natural variation in teaching. Teachers were briefed about the study and were aware that the material covered was to include content that their students would find novel (i.e. they had not discussed it before). All large group lessons were videotaped.

All children were asked a set of follow-up memory questions about the content taught during the lesson. The structure of the memory assessment was designed based on work from educational psychology that has assessed student gains in knowledge after exposure to a technology-enhanced curriculum (Varma & Linn, 2012; Varma, 2014). In this work, open-ended memory recall questions were used to assess pre- and post-curriculum gains in knowledge (Varma & Linn, 2012). In the current project, open-ended recall questions were written about the information taught in each target lesson. The
recall questions were coded and scored 1 if the child answered correctly or 0 if the child answered incorrectly.

Tables 1 and 2 detail the topic and memory questions for each classroom at both time points.

**Table 1.**
Topic and cued recall questions for time 1 memory assessments.

| Topic: Patterns | Time 1  
| Fall 2019 |
|----------------|---------------------------------------------------|
| **Cued Recall Questions** | 1. What is one really important thing about patterns? [Answer: Repeats]  
2. When does a pattern end? [Answer: Never]  
3. Do patterns have to be made with colors? [Answer: No]  
4. What other things can we use to make patterns? [Answer: Shapes, music]  
5. See this? Can you make a pattern with it? [Answer: Star, Square, Star, Square] |

<table>
<thead>
<tr>
<th>Topic: Germs</th>
</tr>
</thead>
</table>
| **Cued Recall Questions** | 1. What does invisible mean? [Answer: You can’t see it]  
2. Are germs invisible? Why? [Answer: Yes. Because you can’t see them]  
3. What does fever mean? [Answer: When your body is too hot]  
4. How do you get rid of germs? [Answer: Wash your hands]  
5. What do we need to do when we wash our hands to keep germs away? [Answer: Soap, water, rinse off, dry them] |

| Topic: Winter clothing |
1. What do you wear in the winter when you want to go outside? [Answer: Boots, Jacket, Scarf, Hat, Mittens, and Boots]
2. Your jacket covers this part (motion) of your body. What is this part of your body that your jacket covers called? [Answer: Torso]
3. What part of your body do each of these clothes cover?
   - Hat: [Answer: Head]
   - Scarf: [Answer: Neck]
   - Pants: [Answer: Legs]
4. What is different about gloves and mittens? [Answer: fingers open vs fingers closed]
5. In what order should you put your winter clothes on? [Answer: Snow pants, boots, jacket, hat, mittens]

**Topic: Hibernation and Migration**

1. Some animals migrate in the winter. What does migrate mean? [Answer: Go south for the winter]
2. Which one of these animals migrates in the winter? (picture of goose/bear) [Answer: Goose]
3. Some animals hibernate in the winter. What does hibernate mean? [Answer: Sleep all winter]
4. Which one of these animals hibernates in the winter? (picture of goose/bear) [Answer: Bear]
5. When you see birds flying in a V shape in the sky, what does this mean they are doing? [Answer: Migrating]
Table 2.
Topic and cued recall questions for each time 2 memory assessments.

<table>
<thead>
<tr>
<th>Time 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spring 2020</td>
</tr>
</tbody>
</table>

**Topic: Symmetry**

<table>
<thead>
<tr>
<th>Cued Recall Questions</th>
<th>1. What does symmetrical mean? [Answer: same on both sides]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2. Is this picture symmetrical or not symmetrical?</td>
</tr>
<tr>
<td></td>
<td>Snowflake (Answer: Symmetrical)</td>
</tr>
<tr>
<td></td>
<td>Dog (Answer: Not Symmetrical)</td>
</tr>
<tr>
<td></td>
<td>Building (Answer: Symmetrical)</td>
</tr>
<tr>
<td></td>
<td>Bug (Answer: Not Symmetrical)</td>
</tr>
<tr>
<td></td>
<td>3. What is the name of the line that is drawn down the middle? [Answer: Line of Symmetry]</td>
</tr>
<tr>
<td></td>
<td>4. How can we make this picture symmetrical? [Answer: Draw other half of a heart]</td>
</tr>
</tbody>
</table>

**Topic: Hibernation**

<table>
<thead>
<tr>
<th>Cued Recall Questions</th>
<th>1. What does hibernation mean? [Answer: sleep in the winter]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2. Do all animals hibernate during the winter? [Answer: No]</td>
</tr>
<tr>
<td></td>
<td>3. What is a den? [A: Cave where animals sleep]</td>
</tr>
<tr>
<td></td>
<td>4. Do all large animals sleep in dens? [Answer: No]</td>
</tr>
<tr>
<td></td>
<td>5. Does this animal hibernate or stay awake during the winter?</td>
</tr>
<tr>
<td></td>
<td>Answers: Snake (Hibernate), Bear (Hibernate), Deer (Awake)</td>
</tr>
<tr>
<td></td>
<td>Wolf (Awake), Turtle (Hibernate), Snail (Awake)</td>
</tr>
<tr>
<td></td>
<td>6. When animals hibernate, how long do they sleep for? [Answer: The entire winter/All winter]</td>
</tr>
</tbody>
</table>

**Topic: Properties of water**

<table>
<thead>
<tr>
<th>Cued Recall Questions</th>
<th>1. What is this [picture] called? [Answer: Ice cube tray]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2. What do you use it for? [Answer: to make ice]</td>
</tr>
<tr>
<td></td>
<td>3. How do you make ice with this? [Answer: fill it with ice and place in the freezer]</td>
</tr>
<tr>
<td></td>
<td>4. Why do you put it in the freezer? [Answer: so that it freezes]</td>
</tr>
<tr>
<td></td>
<td>5. What does the word freezing mean? [Answer: water turning to ice]</td>
</tr>
</tbody>
</table>

**Topic: Pottery**
Cued Recall Questions
1. What shape does a pinch pot start out as? [Answer: Ball/Circle]
2. What is another word that means ball/circle? [Answer: Sphere]
3. How many steps are there to make a pinch pot? [Answer: 3]
4. What is the first thing you do to make a pinch pot? [Answer: Roll into a ball]
5. What is the second step to make a pinch pot? [Answer: Poke a hole]
6. What is the third step to make a pinch pot? [Answer: Pinch all around]

Trust Evaluations. The trust evaluation assessment was administered after the memory assessment. Children were introduced to the 3-point Likert Scale, which was a laminated image of three cups ranging from empty, half full, to full. Children were told that they would be using the cups to tell the experimenter how much someone knows about different things [Epistemic Trust Assessment] or how often someone does different things [Interpersonal Trust Assessment]. Children were then introduced to three stuffed animals one at a time. They were first introduced to Mr. Dragon and told that he doesn’t know anything about new animals [Epistemic] or never helps pick up toys [Interpersonal]. Next, they were introduced to Miss Squirrel and told that she knows everything about new animals or always helps pick up toys. Finally, they were introduced to Bear and told that bear knows some things about new animals but not everything or that he sometimes helps pick up toys but not all the time. Children were asked to point to the cup that matched how much each character knew about new animals or how often each character helped pick up toys. Children’s responses were corrected when necessary.

After familiarizing children to the scale, E produced a picture of the child’s teacher and stated, “Do you know who this is?” All children correctly identified the image as their teacher. Children were then told that they would be using the cups to show E how much their teacher knows about different things [Epistemic] or how often their
teacher does different things [Interpersonal]. Children then responded to the epistemic and interpersonal trust questions. Whether the set of epistemic or interpersonal questions were asked first was counterbalanced across participants.

**Epistemic Trust.** To examine children’s inferences about how epistemically trustworthy they felt their teacher to be, they were asked to evaluate how much knowledge they thought their teacher had across various scenarios and domains. To this end, children responded to 10 questions on a 3-point Likert scale (e.g. “How much does your teacher know about new animals? Nothing, A few things, A lot of things”) which assessed various domains of knowledge and expertise.

**Interpersonal Trust.** To examine children’s inferences about how interpersonally trustworthy they felt their teacher to be, they were asked to evaluate how prosocial or nice they thought their teacher would be across various scenarios and domains. To this end, children responded to 10 questions on a 3-point Likert scale (e.g. “How often does your teacher follow through with what she says she will do? Never, Sometimes, All the time”) which assessed trust in their teacher to help and to fulfill different commitments.

**Selective Trust and Resource Allocation.** Immediately after the trust assessment, the selective trust and resource allocation tasks were administered. These tasks were always administered in the same order (described in detail below). The assessment form can be found in Appendix 3.

**Selective Trust.** An adapted version of the standard selective trust task was administered to account for the use of a single agent (Jaswal, 2004). Children were shown an image of a hybrid object or animal, designed to look like one of two things (e.g., a ball
or a button; a dog or a cat), and asked what they thought it was. Children were then told
that their teacher thought it the opposite of what they said, for example: “You [child]  
think it’s a ball and your teacher says it’s a button. Which one is it, a ball or a button?”
A deference score was calculated by summing the number of trials (out of 4) that children
change their initial response to match their teacher’s. The first two trials were
administered after the first set of resource allocation trials, and the second two trials were
administered after the second set of resource allocation trials.

Resource Allocation. The resource allocation task involved sharing stickers. This
task was originally developed by Moore (2009), who found that preschoolers’ sharing
decisions depended on the target (peer, parent, stranger). Children were shown an image
of their teacher and presented with two types of allocation decisions: prosocial and
sharing. On Prosocial Trials (3 trials) children were told, “You can have one sticker for
yourself now or one for your teacher and one for you later. What would you like to do?”
On Sharing Trials (3 trials), children were told, “You can have two stickers for yourself
now or one for your teacher and one for you later. What would you like to do?” A score
was calculated by summing the number of times children chose to be prosocial or share
divided by the total number of trials, yielding a proportion from 0 to 1 with scores closer
to 1 representing higher rates of sharing. The first two trials were administered after the
interpersonal and epistemic trust evaluations, the second set of trials after the first set of
selective trust questions, and the third set after the second set of selective trust questions.

Executive Function. Forward and backward working memory was assessed using
a word span task. In this task, children are asked to repeat a series of words back to the
experimenter (forward or backward). The span is increased with each success until the
child makes three consecutive failures. Each child received two scores - one for forward span and a second for backward span - that indicated the highest level passed (i.e. the largest sequence of words successfully repeated forward/backward).

**Results**

**Analytic Plan.** All analyses were conducted in R Studio (R Core Team, 2014). Where appropriate, age, gender, classroom, and EF were included as covariates. To begin, the epistemic and interpersonal trust evaluations were examined for internal consistency using Cronbach’s alpha, for test-retest reliability using a subset of the sample who responded to these evaluations twice, and for construct validity by examining the associations between these two evaluations and other indicators of epistemic and interpersonal trust. The results from tests of the psychometric properties of these two trust assessments were used to determine whether the 10-items in each assessment could be collapsed to produce one trust score for epistemic trust and interpersonal trust, respectively. Next, variation in epistemic and interpersonal trust across classrooms and time was examined. Associations between the variables were explored using correlational analyses, and finally, hierarchical regression was used to determine predictors of learning.

**Epistemic and Interpersonal Trust Evaluations.** To begin, the internal consistency of the epistemic and interpersonal trust evaluations was examined. Cronbach’s alpha, a measure of the strength of the correlation between the items in the assessment, was used to assess the internal consistency of the 10 questions in each trust evaluation assessment. Cronbach’s alpha was calculated separately for each measure as the trust evaluations were intended to capture distinct trusting dispositions. Both
assessments had high internal consistency, with alpha’s over the recommended value of 0.70 (Epistemic Trust Evaluation: Cronbach’s alpha = 0.73; Interpersonal Trust Evaluation: Cronbach’s alpha = 0.74).

Next, exploratory factor analysis using principal axis factoring and orthogonal varimax rotation was used to examine the factor structure of the epistemic and interpersonal trust assessments, respectively. First, the factorability of the 10-item Epistemic and Interpersonal assessments was examined using responses from Time 1 (n = 35). The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was 0.58 for Epistemic Trust and 0.40 for Interpersonal Trust. Bartlett’s test of sphericity was significant for both trust assessments, Epistemic Trust ($\chi^2(45) = 141.55, p < 0.001$) and Interpersonal Trust ($\chi^2(45) = 152.70, p < 0.001$). Given the KMO values were not above 0.70, factor analysis was not deemed suitable for either of the 10-item assessments. In the future, a larger sample size will be necessary to perform a factor analysis on these assessments.

There were 28 children who completed the assessments twice: once in the Fall and again in the Spring. Their responses were examined for test-retest reliability. Pearson’s product moment correlation was computed to assess the relationship between the Time 1 and Time 2 evaluations for each trust dimension. There was a significant positive correlation between the assessments for both trust evaluation assessments (Epistemic Trust: Pearson’s $r(26) = 0.56, p < 0.01$; Interpersonal Trust: $r(26) = 0.74, p < 0.001$).

Lastly, construct validity was examined by examining the relationship of the trust evaluation assessments to other measures intended to capture social and epistemic
evaluations. A single score was calculated for each trust evaluation assessment by averaging across the 10-questions. Scores ranged from 0 to 2. Scores closer to 2 represent stronger ratings of trust in the teacher. To examine the construct validity of the interpersonal trust evaluation, it was correlated with the resource allocation task. Resource allocation tasks have been used in other work to demonstrate children’s prosocial attitudes towards agents and was used here as another index of children’s interpersonal trust in their teacher. The selective learning task was used as another index of children’s epistemic trust and has been used in the selective learning literature to document children’s epistemic trust in agents, including teachers (Corriveau & Harris, 2009; Jaswal, 2004). The intercorrelations between these measures are shown in Tables 3 and 4. The trust assessments were not significantly correlated with measures predicted to assess similar constructs. Epistemic trust and interpersonal trust evaluations were significantly correlated at both time points (Time 1: \( r = 0.47, p < 0.01 \); Time 2: \( r = 0.72, p < 0.01 \)).

**Descriptive Statistics and Analyses.** Table 5 below reports the means and standard deviations for each measure at Time 1 and Time 2.

<table>
<thead>
<tr>
<th>Measures</th>
<th>Time 1</th>
<th>Time 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fall 2019</td>
<td>Spring 2020</td>
</tr>
<tr>
<td><strong>M (SD)</strong></td>
<td><strong>M (SD)</strong></td>
<td></td>
</tr>
<tr>
<td><strong>N = 35</strong></td>
<td><strong>N = 32</strong></td>
<td></td>
</tr>
<tr>
<td>Age (year)</td>
<td>3.97 (0.66)</td>
<td>4.22 (0.75)</td>
</tr>
<tr>
<td>Forward Word Span</td>
<td>4.00 (0.84)</td>
<td>4.00 (0.95)</td>
</tr>
<tr>
<td>Backward Word Span</td>
<td>1.74 (0.78)</td>
<td>2.00 (0.88)</td>
</tr>
<tr>
<td></td>
<td>Forward</td>
<td>Backward</td>
</tr>
<tr>
<td>------------------------------</td>
<td>----------</td>
<td>----------</td>
</tr>
<tr>
<td>Resource Allocation</td>
<td>0.27 (0.28)</td>
<td>0.33 (0.33)</td>
</tr>
<tr>
<td>Selective Learning</td>
<td>0.39 (0.35)</td>
<td>0.41 (0.34)</td>
</tr>
<tr>
<td>Epistemic Trust</td>
<td>1.33 (0.41)</td>
<td>1.25 (0.43)</td>
</tr>
<tr>
<td>Interpersonal Trust</td>
<td>1.42 (0.40)</td>
<td>1.47 (0.36)</td>
</tr>
<tr>
<td>Cued Recall</td>
<td>0.55 (0.33)</td>
<td>0.56 (0.33)</td>
</tr>
</tbody>
</table>

Inspection of Table 5 shows that children’s average forward word span did not change across the two time points, but backwards word span did increase, as expected, with age. There were minimal differences in resource allocation and selective learning decisions across the two time points, and overall rates of sharing and deference were low. Epistemic trust and interpersonal trust ratings did not differ across the two time points, though Interpersonal trust evaluations tended to be higher than Epistemic trust evaluations. Cued recall score was similar across both time points.

Variation in the epistemic and interpersonal assessments was explored. Figures 1 and 2 show the average epistemic and interpersonal trust evaluations for each of the four classrooms by time point. Inspection of the figures suggests that while interpersonal trust ratings did not differ over time, there were differences across classrooms. Separate linear mixed effects models were used to examine whether trust differed as a function of classroom or time. In the models, trust score (Model 1: epistemic score; Model 2: interpersonal score) was entered as the dependent variable. Classroom (A - D) and time (Fall, Spring) were entered as predictors. A random intercept with participants nested within classrooms was included. Classroom was a significant predictor of Epistemic scores ($\chi^2(3) = 7.71, p = 0.05$), suggesting that the epistemic trust extended by children
differed across teachers. Neither classroom, nor time were significant predictors of interpersonal trust, suggesting that children tended to evaluate teachers similarly on interpersonal trustworthiness.

Fig 1. Average epistemic trust score by time and classroom

Fig 2. Average interpersonal trust score by time and classroom
Correlations. The intercorrelations between measures were assessed for each time point. These are shown in Tables 3 and 4 and described below.

At Time 1, forward word span \((r = 0.53, p < 0.01)\) and cued recall score \((r = 0.43, p < 0.05)\) were positively correlated with age. Forward and backward word span were positively correlated \((r = 0.36, p < .05)\). Cued recall was positively correlated with forward word span \((r = 0.43, p < 0.01)\). Interpersonal and epistemic trust evaluations were positively correlated \((r = 0.47, p < 0.01)\).

At Time 2, forward \((r = 0.45, p < 0.01)\) and backward \((r = 0.44, p < 0.05)\) word span were positively correlated with age. Forward and backward word span were positively correlated \((r = 0.54, p < 0.01)\). Forward word span was positively correlated with prosocial allocation \((r = 0.41, p < 0.05)\). Cued recall was positively correlated with backward word span \((r = 0.44, p < 0.05)\). As before, interpersonal and epistemic trust evaluations were positively correlated \((r = 0.72, p < 0.01)\).

Predictors of learning and memory. One of the aims of this study was to determine whether trust would be associated with learning above and beyond age and working memory. Hierarchical regression was conducted to evaluate the associations between recall score and dependent measures at each time point. A recall score was calculated for each participant by summing the number of correct responses on the memory assessment and dividing by the number of questions asked. There were 5 questions per class at Time 1, and the number of questions ranged from 4 to 6 at Time 2.

As in Study 1, the variables were entered in 3 steps. Demographic variables were entered at step 1, including age, gender, and classroom. Forward and backward word span scores were entered at step 2 to assess the contributions of a cognitive measure
above and beyond demographic variables. Epistemic and interpersonal trust were entered at step 3 to assess contributions of trust above and beyond demographic and cognitive variables. The results for each time point are discussed in detail below.

Time 1. The results are shown in Table 6. At Step 1, age accounted for significant unique variance in cued recall score (4-year-olds: $\beta = 0.41, t(28) = 3.10, p = 0.004$ and 5-year-olds: $\beta = 0.39, t(28) = 2.41, p = 0.02$). The overall Step 1 model was significant ($F(6, 28) = 3.10, p = 0.01$) and accounted for 27% of the variance in cued recall score.

Step 2 examined the contribution of working memory by including forward and backward word span scores. After controlling for age, gender, and classroom, working memory did not explain additional variance in cued recall score ($F(2) = 0.39, p = ns$).

Step 3 examined the contribution of trust by including epistemic and interpersonal trust scores. Trust did not explain additional variance in cued recall score ($F(2) = 0.30, p = ns$).

Table 6. Summary of hierarchical regression model for analysis of the relationship between time 1 cued recall score, age, gender, working memory, and trust

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Step 1 Estimates</th>
<th>Conf. Int (95%)</th>
<th>P-Value</th>
<th>Step 2 Estimates</th>
<th>Conf. Int (95%)</th>
<th>P-Value</th>
<th>Step 3 Estimates</th>
<th>Conf. Int (95%)</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>0.36</td>
<td>0.11 – 0.61</td>
<td><strong>0.006</strong></td>
<td>0.21</td>
<td>-0.36 – 0.78</td>
<td>0.448</td>
<td>0.35</td>
<td>-0.43 – 1.14</td>
<td>0.360</td>
</tr>
<tr>
<td>Age (4)</td>
<td>0.41</td>
<td>0.14 – 0.68</td>
<td><strong>0.004</strong></td>
<td>0.37</td>
<td>0.03 – 0.71</td>
<td><strong>0.033</strong></td>
<td>0.43</td>
<td>0.05 – 0.81</td>
<td><strong>0.029</strong></td>
</tr>
<tr>
<td>Age (5)</td>
<td>0.39</td>
<td>0.06 – 0.72</td>
<td><strong>0.023</strong></td>
<td>0.30</td>
<td>-0.10 – 0.71</td>
<td>0.136</td>
<td>0.32</td>
<td>-0.10 – 0.75</td>
<td>0.127</td>
</tr>
<tr>
<td>Gender (M)</td>
<td>-0.00</td>
<td>-0.23 – 0.23</td>
<td>0.979</td>
<td>0.01</td>
<td>-0.23 – 0.25</td>
<td>0.928</td>
<td>0.04</td>
<td>-0.22 – 0.30</td>
<td>0.760</td>
</tr>
<tr>
<td>Classroom A</td>
<td>-0.14</td>
<td>-0.40 – 0.12</td>
<td>0.293</td>
<td>-0.13</td>
<td>-0.40 – 0.14</td>
<td>0.319</td>
<td>-0.18</td>
<td>-0.50 – 0.13</td>
<td>0.243</td>
</tr>
<tr>
<td>Classroom B</td>
<td>-0.08</td>
<td>-0.39 – 0.23</td>
<td>0.586</td>
<td>-0.09</td>
<td>-0.42 – 0.23</td>
<td>0.556</td>
<td>-0.14</td>
<td>-0.49 – 0.22</td>
<td>0.433</td>
</tr>
<tr>
<td>Classroom C</td>
<td>-0.26</td>
<td>-0.55 – 0.03</td>
<td>0.073</td>
<td>-0.29</td>
<td>-0.61 – 0.03</td>
<td>0.075</td>
<td>-0.35</td>
<td>-0.73 – 0.03</td>
<td>0.073</td>
</tr>
<tr>
<td>Forward Word Span</td>
<td>0.06</td>
<td>-0.09 – 0.22</td>
<td>0.402</td>
<td>0.07</td>
<td>-0.09 – 0.23</td>
<td>0.405</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Backward Word Span</td>
<td>-0.04</td>
<td>-0.20 – 0.12</td>
<td>0.617</td>
<td>-0.03</td>
<td>-0.21 – 0.14</td>
<td>0.685</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Epistemic Trust</td>
<td>-0.15</td>
<td>-0.56 – 0.25</td>
<td>0.447</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interpersonal Trust</td>
<td>0.03</td>
<td>-0.27 – 0.33</td>
<td>0.832</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Observations 35 35 35
$R^2 / R^2$ adjusted 0.400 / 0.271 0.418 / 0.239 0.432 / 0.196
Time 2. The results are shown in Table 7. At Step 1, classroom accounted for significant unique variance in cued recall score (Classroom B: $\beta = 0.32$, $t(25) = 2.38$, $p = 0.02$). The overall Step 1 model was significant ($F(6, 25) = 4.15$, $p = 0.004$) and accounted for 38% of the variance in cued recall score. Classroom variation in recall scores may be attributed to differences in the attentiveness of the children, the topic and how familiar children were with it prior to learning about it during large group time, or the recall questions, which were different for each class. Step 2 examined the contribution of working memory by including forward and backward word span scores. After controlling for age, gender, and classroom, working memory significantly improved the model ($\Delta R^2 = 0.11$, $F(2) = 3.72$, $p = 0.04$, $R^2 = 0.49$). Specifically, backward working memory score was a significant predictor of cued recall score ($\beta = 0.16$, $t(23) = 2.57$, $p = 0.01$), suggesting that greater backward span increased recall. Step 3 examined the contribution of trust by including epistemic and interpersonal trust scores. Trust did not explain additional variance in cued recall score ($F(2) = 0.94$, $p = ns$).
Discussion

While much is known about children’s epistemic and interpersonal evaluations of agents in experimental settings, little is known about how these distinct reasons to trust function in naturalistic settings. Educational contexts provide one natural extension of this experimental work. Educational psychologists have noted the importance of trust for student academic achievement and have found that building positive teacher-student interactions is one way to promote academic achievement, perhaps by way of cultivating trust. For preschool-aged children, preschool classrooms offer many their first introduction to a teacher who will serve as a new and important source of knowledge and emotional security. Moreover, we know from abundant research in child development that by the preschool years, children’s epistemic and interpersonal evaluations of agents impact their learning decisions.
One assumption in the field is that preschoolers evaluate teachers positively. For example, an article examining preschool-aged children’s judgments about knowledge and expertise found that at this age, children correctly identified agents as likely to have knowledge about certain topics based on occupation (e.g. car mechanic knows about cars) (Lutz & Keil, 2002). However, the authors noted that teacher figures were intentionally excluded as “teachers often appear to children as experts on a multitude of topics” (Lutz & Keil, 2002). If the experimental work showing children’s epistemic trust can be changed based on epistemic information about agents is generalizable to real-world applications, then children’s evaluations of adult teachers with whom they interact in real life may be subject to variation if teachers differ in epistemic behavior.

The current study found evidence supporting this, as children’s epistemic trust in their teacher differed across the four classrooms sampled. Though children’s epistemic trust was subject to variation, their interpersonal trust did not differ across the four classrooms and was generally high. This suggests two important things. First, that there are reasons to differentiate between epistemic and interpersonal trust. Second, that epistemic trust may be particularly susceptible to variation across classrooms as early as the preschool years. These findings support experimental work showing children’s selective extensions of epistemic trust, but in a naturalistic setting. When the target agent is a familiar teacher, children at this age appear to be sensitive to indicators of knowledge or expertise and apply it to questions assessing epistemic trustworthiness. More work is needed to determine what specific teacher behaviors resulted in variation in children’s epistemic assessments. One way to begin identifying this would be to ask children to respond to open ended questions asking them to identify why they rated their teacher as
having (or not having) knowledge in a certain domain or situation. Observational tools could be used to document the types of epistemic behaviors or statements that teachers make in classrooms and examine how they relate to children’s ratings. More work is needed to better understand what specific components of the teacher or classroom experience impact epistemic trust.

Though epistemic trust appeared to vary across classrooms, it was not related to differences in learning. Hierarchical regression models found that age (Time 1), classroom (Time 2), and backward word span (Time 2) were significant predictors of learning and memory. Classroom differences may be attributed to individual differences in child attentiveness to the lesson, which may have been lower for those in the youngest age group (3-year-olds). Future work could examine this possibility by obtaining individual differences data on student temperament or engagement in the classroom. The different lesson topics and questions may be another reason that differences in recall across classrooms were found. Though allowing the teachers to teach on a topic of their choosing gave them the ability to tailor the material to their particular set of students, it makes it difficult to rule out the possibility that the topic and questions asked were more difficult for certain classrooms. This could be investigated by designing lessons and questions that are identical across a set of classrooms. However, in the present work, teachers were given the opportunity to teach on a topic of their choosing to allow for natural variation in teaching behavior. Moreover, this was done to ensure that teachers were teaching on a topic that was unfamiliar to the children (they had not taught about it before) and that they were relatively familiar and confident teaching. Research has shown that when teachers are asked to teach material that they are less familiar with (e.g. STEM
content), they may display less confidence while instructing (Park et al., 2017), a cue that could have an impact on children’s learning. Here, the goal was to allow the teachers the ability to maintain their usual demeanor while teaching so that children’s learning was not impacted by differences in the target lesson relative to how lessons are typically taught. Of course, this resulted in variation in how the lessons were taught, in ways that could have impacted how well children encoded the information. For example, some lessons were taught by reading a book aloud to the children, while other lessons were teachers providing information with pictures or material objects. The lessons included varied levels of interactive exercises, and differed in length depending on these exercises. These differences in teaching style and classroom dynamics are all likely related to children’s learning, and it will take a larger sample and more work to fully examine the impact that these differences have on learning.

Executive function, and specifically, working memory has been found to be an important predictor of learning in kindergarten (Fitzpatrick & Pagani, 2012), and in the current study, it was a significant predictor of learning at the time 2 assessment. Indeed, while age was a significant predictor of cued recall score at Time 1, backward word span explained variation in recall score above and beyond age at Time 2, suggesting that EF may be an important contributor to learning as measured in this study. This finding is supported by work showing that for preschoolers and kindergarteners, EF is an important skill that can aid in children’s learning because it allows them to self-regulate, inhibit disruptive behavior and focus on tasks at hand (Diamond, 2012). This suggests that it is important to consider ways to promote EF skills in children in order to promote school readiness and academic achievement.
Nevertheless, the current work suggests that it may be important to consider how teacher-behavior can impact children’s trust as early as the preschool years, and the extent to which trust might impact how children interact with teachers and engage with material in the classroom. Recent work with high schoolers suggests that children with lower levels of institutional trust and teacher-specific trust had more disruptive and disengaged behavior in classrooms (Amemiya, Fine, & Wang, 2019). If we consider this finding in relation to a younger age group, perhaps children with lower levels of trust in their teacher exert less effort in using executive functioning skills. Indeed, recent theoretical accounts of executive functioning suggest that these skills are utilized to serve different goals, depending on the context (Doebel, 2019). Thus, one possibility is that lower levels of trust could impact use of EF in the classroom, through which academic achievement is undermined. While the present study cannot answer this, future work could consider the role that trust plays as a potential mediator between EF and achievement.

Study 2 is one of the first attempts to evaluate whether variation exists in preschool-aged children’s epistemic and interpersonal trust in their teacher, and the extent to which these varieties of trust impacts learning. Novel assessments were designed drawing upon work evaluating children’s epistemic and interpersonal judgments of agents conducted in laboratory experimental work. Variation in epistemic trust suggests that by the preschool years, children are sensitive to the epistemic status of teachers, though it remains unclear what specific aspects of teachers or classrooms are attributable to these differences. High ratings of interpersonal trust across the classrooms suggests that this is a variety of trust distinct from epistemic trust, and aligns with expectations.
that preschoolers tend to positively evaluate their teachers. More work will be needed to
determine the psychometric properties of these assessments by including a wider age
range and a larger sample size. Moreover, though trust was not related to learning in the
current project, it will be necessary for future work to explore ways in which trust
impacts other components that impact learning, such as executive function or attention.
General Discussion

The two studies conducted in this dissertation aimed to begin developing ways to measure differentiated forms of trust in individual children and to examine the impact of trust on learning. This work offers an initial step in translating empirical work on children’s selective epistemic trust to more applied contexts, specifically in early childhood classrooms.

My aim in Study 1 was to examine whether variation exists in preschool-aged children’s epistemic and interpersonal trust using novel assessments measuring these distinct trusting dispositions. The two 10-item assessments were generated after reviewing work across the developmental literature assessing children’s judgments of knowledge and expertise (Lutz & Keil, 2002) as well as their benevolence judgments about agents (Johnston, Landrum, Mills, 2013; Rowles & Mills, 2018). In previous studies, the questions were used to determine if preschoolers were capable of making accurate epistemic and interpersonal judgments about agents who were manipulated to embody varied levels of these characteristics. While this work has shown that preschoolers can indeed make accurate judgments in light of evidence about agents’ epistemic or interpersonal traits, it remained unclear whether these types of evaluations could be found in more natural interactions where knowledge and benevolence were not strongly manipulated or isolated. Children in Study 1 were randomly assigned to interact with an adult who taught them new information about an animal and an object in either a highly interpersonal, low epistemic way or in a highly epistemic, low interpersonal way. The manipulation was effective in reducing children’s epistemic trust, as measured with my new 10-item epistemic trust evaluation. However, interpersonal trust was not
impacted by condition, with children reporting high interpersonal trust in both agents. I suggested that this could be due to the high epistemic agent’s calibrated nature; that is, when she made a claim about knowledge, she followed through and gave the information, which could have been viewed as a positive interpersonal characteristic. It is also possible that the interaction children had with the high epistemic, low interpersonal adult did not result in any strong interpersonal damage to the relationship. The agent simply taught information and made clear the importance of learning in this context.

In Study 2, preschoolers were recruited from four mixed-aged classrooms at a campus-based preschool. The purpose of this was to extend the questions and measures from Study 1 to an applied setting. Children were asked to evaluate their lead teacher instead of an agent that they had briefly interacted with in the lab, offering a potentially more powerful test of the epistemic and interpersonal trust evaluations in an agent with whom children have had more extensive experience. While children’s epistemic trust differed as a function of classroom, their interpersonal trust did not. Interestingly, this is the same pattern that emerged in Study 1. This offers initial support for differentiating between these two types of trust - as it appears that one can be impacted by teacher behavior more than the other at this age. Further, this finding suggests that preschoolers may be aware of and attending to indicators of knowledge and expertise in adults around them, including their teachers, and work will need to continue to explore what behaviors support epistemic trust so that teachers can cultivate that with their students. It is difficult to determine what caused differences in epistemic trust in Study 2. However, based on the findings from Study 1, it’s possible that differences might be attributed to statements about ignorance (e.g. “I don’t know about that”, “I’ve never seen it before”) or lack of
calibration (e.g. making claims about ignorance, but then providing information). Indeed, in educational contexts, it is not uncommon for teachers working with young children to make claims about ignorance in order to stimulate learning. For example, a student who asks how something works or how to do something might be told by a teacher “I don’t know, what do you think?” While this could stimulate the child’s own exploration in the learning process, it could be that these claims reflect back on the epistemic status or quality of the teacher. While this can only be conjectured here, more work is needed to better understand the impact of teacher behavior on children’s epistemic and interpersonal trust.

In both studies, neither epistemic nor interpersonal trust were related to learning. The best predictors of learning were backward word span and age. Learning was assessed by asking children to respond to a set of open-ended recall questions (e.g. “Where does this animal live?”, “When does a pattern end?”). Open-ended questions were used to allow for consistency across the two studies, and to allow for more variation in recall scores. However, the use of open-ended questions could have made it difficult for the younger children to respond accurately, leading to better recall with age and working memory capacity. Other metrics for assessing learning have been used in studies showing relationships between trust and academic achievement, including scores on standardized assessments (e.g. Woodcock-Johnson Test of Cognitive Abilities, Woodcock, 1977) or cognitive mechanisms that support learning, like task persistence, attention, and motivation (Coolahan et al, 2000; Fantuzzo et al, 2004). Thus, it is possible that epistemic and/or interpersonal trust are related to different measures of learning that were not used in the work presented here. Another possibility is that trust plays a larger role in learning
later in development. To this end, it will be interesting for future work to explore whether there is variation in children’s epistemic and interpersonal trust in the elementary school years and how it might impact learning at different ages. Additional metrics assessing learning will be useful to understand whether trust impacts learning in general (e.g. a grade in a class) or learning of specific material (e.g. a classroom assignment). Finally, as proposed in Study 2, it may be that trust is a mediator between executive function - which has been found to be a reliable indicator of school readiness - and academic achievement. While EF certainly plays an important role in children’s abilities to learn in classroom settings, teacher quality also has powerful effects on the classroom environment and might be impacting children’s trust, which might then affect EF and academic achievement or engagement.

Together, these studies offer new directions for exploring children’s trust and the impact that it has on learning. Grounded in abundant experimental work showing that preschoolers’ epistemic and interpersonal trust can be moved based on agent characteristics, the studies carried out here sought to extend these ideas to an applied setting. The novel epistemic and interpersonal trust assessments used across these two studies offer one approach for measuring trust in classroom settings by asking children to evaluate how knowledgeable and nice an adult is across various scenarios and domains. In the current work, epistemic and interpersonal trust were differentiated, and epistemic trust was more flexibly extended. While these were not related to learning as measured in these studies, future work can begin to explore questions associated with trust and learning by examining different age groups and metrics for assessing learning. Additionally, future work can explore how different agents are evaluated (e.g. parents,
strangers), can better substantiate the psychometric properties of these assessments with a larger sample, and can explore more carefully the types of behaviors that are important to foster students’ epistemic and interpersonal trust.
### Study 2 Correlation Tables

#### Table 6

*Time 1: Means, standard deviations, and correlations with confidence intervals*

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*Note.* M and SD are used to represent mean and standard deviation, respectively. Values in square brackets indicate the 95% confidence interval for each correlation. The confidence interval is a plausible range of population correlations that could have caused the sample correlation (Cumming, 2014). * indicates $p < .05$. ** indicates $p < .01$. 
Table 7  
*Time 2: Means, standard deviations, and correlations with confidence intervals*

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*Note. M and SD are used to represent mean and standard deviation, respectively. Values in square brackets indicate the 95% confidence interval for each correlation. The confidence interval is a plausible range of population correlations that could have caused the sample correlation (Cumming, 2014). * indicates $p < .05$. ** indicates $p < .01.$*
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Appendix 1: Scripts for Study 1 teaching phase.

Condition 1: High Interpersonal, Low Epistemic

Animal Facts

*Sit next to child at table*

Hi [child’s name]
My name is [your name].
How are you today?
Welcome to the learning room!
I’m so excited to learn new things with you today!
Right now, we’re going to learn about a new animal.
I’ve never seen the animal that we’re going to learn about.
I don’t know anything about it.
We’re going to look at a picture of this animal.
Are you ready?!

*Bring out picture and state facts*
Thank you for listening!

Object Demonstration

You’re doing a great job [child’s name]!
I’m so excited to show you the next thing that we’re going to learn about.
We’re going to learn how to use a new toy.
I’ve never seen the toy that we’re going to learn how to use.
I don’t know how to use it.
Here it is!
Hmm, I think this is how you use it.

*Actions*
1. Touch RED object to nose
2. Place RED object in hole on bottom right
3. Rub left arm with YELLOW object
4. Place YELLOW object in hole on bottom left
5. Place GREEN on top of head
6. Place GREEN in center

Thank you for watching!
You did such a good job today [child’s name]!
Now, I’m going to get someone else who’s going to ask you some questions.
**Condition 2: High Epistemic, Low Interpersonal**

**Animal Facts**

*Stand in front of child across table*

Hi.
My name is [RA name].
Today is [day of the week].
You are in the learning room.
You’re going to learn new things today.
Right now, you’re going to learn about a new animal.
I have seen the animal that you’re going to learn about.
I know everything about it.
I’m going to show you a picture of this animal.
Do you understand?

*Bring out picture and state facts*
Those are the facts.

**Object Demonstration**

Good.
Now you’re going to learn the next thing.
I’m going to show you how to use a new toy.
I’ve seen the toy that you are going to use before.
I know everything about how to use it.
Here it is.
This is how you use it.

*Actions*
1. Touch RED object to nose
2. Place RED object in hole on bottom right
3. Rub left arm with YELLOW object
4. Place YELLOW object in hole on bottom left
5. Place GREEN on top of head
6. Place GREEN in center

That’s how you use it.
Good.
Now, I’m going to get someone who is going to ask you some questions.
Appendix 2: Epistemic and Interpersonal Trust Evaluations

Study 1: Trust Evaluations Order 1 (E, I)

“Remember this person? [image of agent] I’m going to ask you some questions about her”

E1. Some people know a lot about new animals and some people do not.

Does she know a lot about new animals? YES NO

I1. Some people keep every promise they make, and some people do not.

Does she keep her promises? YES NO

E2. Some people know a lot about food at the grocery store and some people do not.

Does she know a lot about food at the grocery store? YES NO

I2. Some people follow through with what they say they will do, like giving out stickers, and some people do not.

Does she follow through with what she says she will do? YES NO

E3. Some people know a lot about why plants need sunlight to grow, and some people do not.

Does she know a lot about why plants need sunlight to grow? YES NO

I3. Some people are really good at listening to others, and some people are not.

Is she good at listening to others? YES NO

E4. Some people know a lot about why apples are sweet, and some people do not.

Does she know a lot about why apples are sweet? YES NO

I4. Some people help other when they need help, and some people do not.

Does she help others when they need help? YES NO

E5. Some people know a lot about why some dogs have 8 puppies, and some people do not.

Does she know a lot why some dogs have 8 puppies? YES NO
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<tbody>
<tr>
<td><strong>15. Some people keep every secret that they are told, and some people do not.</strong></td>
<td>Does she keep every secret that she’s told?</td>
<td>YES NO</td>
</tr>
<tr>
<td><strong>E6. Some people know a lot about kinkajous and some people do not.</strong></td>
<td>Does she know a lot about kinkajous?</td>
<td>YES NO</td>
</tr>
<tr>
<td><strong>I6. Some people always cooperate with others, and some people do not.</strong></td>
<td>Does she always cooperate with others?</td>
<td>YES NO</td>
</tr>
<tr>
<td><strong>E7. Some people know a lot about why fish can only live in water, and some people do not.</strong></td>
<td>Does she know a lot about why fish can only live in water?</td>
<td>YES NO</td>
</tr>
<tr>
<td><strong>I7. Some people share their toys with others, and some people do not.</strong></td>
<td>Does she share her toys with others?</td>
<td>YES NO</td>
</tr>
<tr>
<td><strong>E8. Some people know a lot about cars, and some people do not.</strong></td>
<td>Does she know a lot about cars?</td>
<td>YES NO</td>
</tr>
<tr>
<td><strong>I8. Some people act silly to make other people laugh, and some people do not.</strong></td>
<td>Does she act silly to make other people laugh?</td>
<td>YES NO</td>
</tr>
<tr>
<td><strong>E9. Some people know rules for lots of games, and some people do not.</strong></td>
<td>Does she know about rules for lots of games?</td>
<td>YES NO</td>
</tr>
<tr>
<td><strong>I9. Some people help others clean up messes, and some people do not.</strong></td>
<td>Does she help others clean up messes?</td>
<td>YES NO</td>
</tr>
<tr>
<td><strong>E10. Some people know a lot about how chickens lay eggs, and some people do not.</strong></td>
<td>Does she know a lot about how chickens lay eggs?</td>
<td>YES NO</td>
</tr>
<tr>
<td><strong>I10. Some people say they’re sorry when they upset others, and some people do not.</strong></td>
<td>Does she say sorry when she upsets others?</td>
<td>YES NO</td>
</tr>
</tbody>
</table>
Study 2: Trust Evaluations Order 1 (E, I)

Introduction to Epistemic Scale:

For this game, we’re going to use a scale. It looks like this. You’re going to use it to show me how much someone knows about things. This means someone knows everything, this means someone knows a few things, and this means someone knows nothing. Let’s try using it!

Example 1: This is Mr. Dragon. Mr. Dragon doesn’t know anything about new animals. Can you point on this scale to how much Mr. Frog knows about new animals?
Response: ________________

Example 2: This is Miss Squirrel. Miss Squirrel knows everything about new animals. Can you point on this scale to how much Miss Squirrel knows about new animals?
Response: ________________

Example 3: This is bear. Bear knows some things about new animals, but not everything. How much does Bear know about new animals?
Response: ________________

[Produce picture of teacher]
“You know Teacher [name]? I’m going to ask you some questions about her and I want you to use this scale to tell me how much you think she knows about different things.”

E1. Some people know a lot about new animals and some people do not.

How much does Teacher [Name] know about new animals?

Nothing  A few things  Everything

E2. Some people know a lot about food at the grocery store and some people do not.

How much does Teacher [Name] know about food at the grocery store?

Nothing  A few things  Everything

E3. Some people know a lot about why plants need sunlight to grow, and some people do not.

How much does Teacher [Name] know about why plants need sunlight to grow?

Nothing  A few things  Everything

E4. Some people know a lot about why apples are sweet, and some people do not.
How much does Teacher [Name] know about why apples are sweet?

Nothing  A few things  Everything

**E5. Some people know a lot about why some dogs have 8 puppies, and some people do not.**

How much does Teacher [Name] know about why some dogs have 8 puppies?

Nothing  A few things  Everything

**E6. Some people know a lot about cooking food and some people do not.**

How much does Teacher [Name] know about cooking food?

Nothing  A few things  Everything

**E7. Some people know a lot about why fish can only live in water, and some people do not.**

How much does Teacher [Name] know about why fish can only live in water?

Nothing  A few things  Everything

**E8. Some people know a lot about cars, and some people do not.**

How much does Teacher [Name] know about cars?

Nothing  A few things  Everything

**E9. Some people know rules for lots of games, and some people do not.**

How much does Teacher [Name] know about rules for games?

Nothing  A few things  Everything

**E10. Some people know a lot about how chickens lay eggs, and some people do not.**

How much does Teacher [Name] know about how chickens lay eggs?

Nothing  A few things  Everything
Introduction to Interpersonal Trust Scale:

For the next questions, we’re going to use a different scale. It looks like this. You’re going to use it to show me how often someone does things. This means everytime, this means sometimes, and this means never. Let’s try using it!

Example 1: This is Mr. Dragon. Mr. Dragon never helps pick up toys. Can you point on this scale to how often Mr. Dragon helps pick up toys?
   Response: ________________

Example 2: This is Miss Squirrel. Miss Squirrel always helps pick up toys. Can you point on this scale to how often Miss Squirrel helps pick up toys?
   Response: ________________

Example 3: This is bear. Bear sometimes helps pick up toys but not everytime. Can you point on this scale to how often bear helps pick up toys?
   Response: ________________

[Produce picture of teacher]

“You know Teacher [name]? I’m going to ask you some questions about her and I want you to use this scale to tell me how often she does different things.”

11. Some people keep every promise they make, and some people do not.

How often does Teacher [Name] keep her promises?

Never               Sometimes               Every time

12. Some people follow through with what they say they will do, like giving out stickers, and some people do not.

How often does Teacher [Name] follow through with what she says she will do?

Never               Sometimes               Every time

13. Some people are really good at listening to others, and some people are not.

How often does Teacher [Name] listen to others?

Never               Sometimes               Every time

14. Some people help other when they need help, and some people do not.

How often does Teacher [Name] help others when they need help?

Never               Sometimes               Every time
15. Some people help others when they are sad, and some people do not.
   How often does Teacher [Name] help others when they are sad?
   Never          Sometimes          Every time

16. Some people always cooperate with others, and some people do not.
   How often does Teacher [Name] cooperate with others?
   Never          Sometimes          Every time

17. Some people share their toys with others, and some people do not.
   How often does Teacher [Name] share toys with others?
   Never          Sometimes          Every time

18. Some people act silly to make other children laugh, and some people do not.
   How often does Teacher [Name] act silly to make other children laugh?
   Never          Sometimes          Every time

19. Some people help children clean up messes, and some people do not.
   How often does Teacher [Name] help children clean up their messes?
   Never          Sometimes          Every time

20. Some people say they’re sorry when they upset others, and some people do not.
   How often does Teacher [Name] say sorry when she upsets others?
   Never          Sometimes          Every time
Appendix 3: Selective Trust, EJT, and Resource Allocation Tasks

Explicit Judgment Questions

EJT1a: Is she very smart?  
YES  NO

EJT1b: Is she very nice?  
YES  NO

Resource Allocation Task (Adapted from Moore, 2009)

Instructions: We’re going to play a choosing game. In this game, sometimes you might choose stickers just for you, and sometimes you might choose to share stickers. If you want the stickers for yourself, I’ll give them to you right away to put in your sticker book. If you want to share the stickers, they go in this envelope and will be given to you and her (point to teacher) when the game is finished.

Okay. You can have one sticker for yourself now or two stickers for yourself now. What would you like to do?

** If child chooses 1 sticker, say: You can take two stickers if you want!

Prosocial Trial 1: You can have one sticker for yourself now or one sticker for her (point to picture of teacher) and one for you later. What would you like to do?

Child’s response _______________________

Sharing Trial 1: You can have two stickers for yourself now or one sticker for her (point to picture of teacher) and one for you later. What would you like to do?

Child’s response _______________________

50-50 Classification

Object Categorization: Look at this funny thing! I wonder if it’s a spoon or a key. If it’s a spoon, it goes in the bowl (point to bowl). If it’s a key, it unlocks the door (point to the door). What do you think, is it a spoon or a key?

SPOON  KEY

Object Endorsement: *point to picture of teacher* She says this is a [opposite of child]. So you think it’s a [spoon/key] and she said it’s a [spoon/key]. Which one is it, a spoon or a key?

SPOON  KEY

Animal Categorization: Look at this funny animal! I wonder if it’s a squirrel or a rabbit. If it’s a squirrel, it eats the nuts (point to nuts). If it’s a rabbit, it eats the carrots (point to carrots). What do you think, is it a squirrel or a rabbit?

SQUIRREL  RABBIT
Animal Endorsement: *point to picture of teacher* She says this is a [opposite of child]. So you think it’s a [squirrel/rabbit] and she said it’s a [squirrel/rabbit]. Which one is it, a squirrel or a rabbit?

SQUIRREL
RABBIT

Explicit Judgment Questions
EJT2a: Is she very smart? YES NO
EJT2b: Is she very nice? YES NO

Resource Allocation Task (Adapted from Moore, 2009)
Instructions: *We’re going to play a choosing game. In this game, sometimes you might choose stickers just for you, and sometimes you might choose to share stickers. If you want the stickers for yourself, I’ll give them to you right away to put in your sticker book. If you want to share the stickers, they go in this envelope and will be given to you and her (point to teacher) when the game is finished.*

Prosocial Trial 2: You can have one sticker for yourself now or one sticker for her (point to picture of teacher) and one for you later. What would you like to do?
Child’s response _______________________

Sharing Trial 2: You can have two stickers for yourself now or one sticker for her (point to picture of teacher) and one for you later. What would you like to do?
Child’s response _______________________

75-25 Classification
Object Categorization: Look at this funny thing! I wonder if it’s a ball or a button. If it’s a ball, it goes through the hoop (point to hoop). If it’s a button, it goes in the coat (point to the coat). What do you think, is it a ball or a button?

BALL
BUTTON

Object Endorsement: *point to picture of teacher* She says this is a [opposite of child]. So you think it’s a [ball/button] and she said it’s a [ball/button]. Which one is it, a ball or a button?

BALL
BUTTON

Animal Categorization: Look at this funny animal! I wonder if it’s a dog or a cat. If it’s a dog, it eats the bones (point to bones). If it’s a cat, it drinks the milk (point to milk). What do you think, is it a dog or a cat?

DOG
CAT

Animal Endorsement: *point to picture of teacher* She says this is a [opposite of child]. So you think it’s a [dog/cat] and she said it’s a [dog/cat]. Which one is it, a dog or a cat?
Explicit Judgment Questions

EJT3a: Is she very smart?  
       YES  NO

EJT3b: Is she very nice?  
       YES  NO

Resource Allocation Task (Adapted from Moore, 2009)

Instructions: We’re going to play a choosing game. In this game, sometimes you might choose stickers just for you, and sometimes you might choose to share stickers. If you want the stickers for yourself, I’ll give them to you right away to put in your sticker book. If you want to share the stickers, they go in this envelope and will be given to you and her (point to teacher) when the game is finished.

Prosocial Trial 3: You can have one sticker for yourself now or one sticker for her (point to picture of teacher) and one for you later. What would you like to do?
Child’s response _______________________

Sharing Trial 3: You can have two stickers for yourself now or one sticker for her (point to picture of teacher) and one for you later. What would you like to do?
Child’s response _______________________