

‘What do YOU think?’: Children’s questions, teacher’s responses and children’s follow-up across diverse preschool settings

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ABSTRACT

Studies have shown differences in how parents respond to children’s questions across diverse socio-economic backgrounds. Differences in these interaction patterns have the potential to set the stage for a mismatch between children’s approach to asking questions and behaviors privileged in formal school settings. In the current study, we explored question, response follow-up language interactions in socio-economically diverse preschools. We compared interaction patterns across 20 preschool classrooms (10 low-SES; 10 mid-SES). Results indicated that children across both settings asked a similar proportion of information seeking questions. There were no differences in the number of explanatory responses children received, however, teachers from low-SES classrooms were significantly less likely to turn the question back than teachers serving children from mid-SES background – resulting in differences in children’s follow-up. Children from low-SES classrooms were more likely to repeat their original question than any other type of follow up; whereas children from mid-SES classrooms were more likely to generate their own explanation. These findings have important implications for understanding how children across diverse preschool settings navigate the types of interactions they will likely be expected to engage in and learn from during formal schooling.

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1. Introduction

Children are active learners, acquiring information about their world in multiple ways—through observation, by exploring, manipulating, and experimenting with materials in the world (Piaget, 1976), by asking questions (Chouinard, Harris & Maratsos, 2007; Ronfard, Bartz, Cheng, Chen & Harris, 2018), by reading or being read to (Cunningham & Stanovich, 1991), by being told information by others (c.f., testimony; Harris & Koenig, 2006; Heyman, 2008; Jaswal, Croft, Setia & Cole, 2010; Koenig & Echols, 2003), or by some combination of these approaches. Through these experiences, children learn about the world and develop different types of concepts (e.g. categories, properties, events, states, individuals, abstract ideas) that aid in their interpretation of subsequent experiences in the world (Greif, Kemler Nelson, Keil & Gutierrez, 2006). And in turn, these learning experiences result in a variety of other positive learning outcomes. For example, content knowledge contributes substantially to reading achievement and school success (Duncan et al., 2007). All children are amass-

ing conceptual knowledge in their first years of life, yet, not all young children have the opportunity to engage in the types of activities that lend themselves to conceptual knowledge acquisition that is valued in school, which could be associated with large and early gaps in conceptual knowledge (Neuman & Celano, 2006), vocabulary (Fernald, Marchman & Weisleder, 2013), and information-seeking behavior (Chouinard et al., 2007).

For these reasons, it is imperative that researchers and educators take seriously the task of conceptual knowledge development and associated vocabulary during preschool to ensure that all children begin school prepared to succeed. This study is designed to investigate how preschool children engage in 1 information-seeking behavior that has the potential to foster their conceptual knowledge: asking questions. Indeed, previous studies have shown that there is considerable variability in children’s question-asking behavior in their homes based on socioeconomic status (Kurkul & Corriveau, 2018) and cultural background (Butler, Ronfard & Corriveau, 2020; Solis & Callanan, 2016). Indeed, in families from low-SES backgrounds, children are more likely to be direct with their speech and use questions to illicit certain behaviors. In contrast, children from mid-SES backgrounds often use questions as a mechanism for acquiring information and extending conversation background (Butler et al., 2020; Solis & Callanan, 2016). Moreover, for

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some children, the question-asking behaviors they typically use in their home during language interactions with their caregivers matches seamlessly with the question-asking behaviors expected and privileged in formal school settings. For others, there is a mismatch between these 2 settings. In the current study, we focus on question-asking exchanges in early childhood education settings and explore how questions and explanations are used in preschools serving children from a variety of sociodemographic backgrounds. We anticipate similarities in question-asking exchanges, suggesting that the language interactions that children experience in their preschool setting may serve to help introduce the types of exchanges that will likely be the type of interactions they will be expected to engage in and learn from during formal schooling (Chin & Osborne, 2008; King, 1994; Michaels, O'Connor & Resnick, 2008; Resnick, Michaels & O'Connor, 2010).

A vast array of research suggests that young children learn in myriad ways. One of the primary catalysts for children's learning is through exploration, manipulation, and experimentation with materials in the world (Chouinard et al., 2007; Gopnik & Meltzoff, 1997). Yet if this were the only source of information children had about the world, many important concepts would elude them. There are critically important scientific phenomena, abstract concepts, future events, and invisible referents that are not accessible to children through hands-on exploration (Corriveau & Kurkul, 2014). Take, for example, the concept of bird migration. Though a 4-year-old child may be able to observe a flock of geese flying in a v-shape, there is little else about the concept of migration that a child can discern through observation and exploration. To fully learn about such a concept, children must rely on information provided by others (Bruner, 2009; Harris, 2012; Mills & Landrum 2014). Although adults and other interlocutors may spontaneously provide the information children seek, another critically important way that children acquire information about the world around them is through actively seeking out the information they desire.

There is substantive evidence that from an early age children are actively seeking information about the world from the adults around them. Before children are 12 months old, they are capable of engaging in social referencing (Walden, 1993), attending to head direction, body posture, and eye gaze to understand the focus of adults' attentional focus (Brooks & Meltzoff, 2005; 2014), and using pointing as means of recruiting parental attention to an object of interest (Butterworth, 2003; Camaioni, Perucchini, Bellagamba & Colonesi, 2004; Lucca & Wilbourn, 2018). These behaviors are consistent across children from diverse economic and cultural backgrounds.

Eventually, children acquire the requisite language skills and cognitive dispositions necessary to seek information about the world using questions posed to adults around them. Indeed, asking questions eventually becomes 1 of the primary means through which young children acquire information about the world (Callanan & Oakes, 1992). In fact, by age 3, children ask an average of 76 information-seeking questions per hour (Chouinard et al., 2007) and by age 5, children are capable of formulating sophisticated and effective questions for solving problems (Lombrozo, 2016; Mills, Legare, Bills & Mejias, 2010; Ruggeri & Lombrozo, 2015; Walker, Lombrozo, Legare & Gopnik, 2014).

Some have posited that questions are a powerful means of knowledge acquisition because they provide a mechanism that allows children to get targeted information about a phenomena or topic at the exact point when they need that information—at the point of disequilibrium between their current knowledge and their encounter with new and/or conflicting objects, phenomena, or information (e.g., Butler et al., 2020; Chouinard et al., 2007). Research has shown that when children are given information in response to a question they posed, they retained that informa-

tion significantly better than when information was given to them without their asking a question (Chouinard et al., 2007). Similarly, interventions focusing on training children to engage in self-questioning is associated with greater learning and retention of information (Chiu & Chi, 2014; Legare & Lombrozo, 2014).

Importantly, if children's questions are to be useful in moving "their knowledge structures closer to adult-like states" (Chouinard et al., 2007, p. vii), the answers they are given by the adults around them must be informative. Many of the earliest questions that children ask are "What?" and "Where?" questions that often require only simple 1 word answers in order to be informative. However, typically developing children begin to shift toward asking more "How?" or "Why?" questions, requiring adults around them to provide a more complex explanation in order to respond adequately (Chouinard et al., 2007; Corriveau & Kurkul, 2014; Frazier, Gelman & Wellman, 2009; Kurkul & Corriveau, 2018; Issacs, 1930). Arguably, the questions that children pose and the adequacy of the explanations that they receive are 1 means by which children acquire new conceptual knowledge about the world around them. Adequate adult explanations can provide children with vocabulary and information that they otherwise would not be able to access through exploration and observation (Frazier et al., 2009).

In contrast, children's questions provide caregivers with the opportunity to offer non-circular explanations that are rich, complex, and elaborate. For example, given the child question posed in the previous paragraph "Why does it get dark at night?" the adult might respond "Well, we live on the earth and the earth rotates, or goes around in a circle each day. During some parts of that trip around in a circle, we are facing the sun so there is light and it is daytime. At other parts of that trip around in a circle, we are facing away from the sun, so it is dark and it is nighttime". Moreover, some parents may respond with a pedagogical question (e.g., children assume parent already knows the answer when she asks "What does this button do?"). Responses such as these provide fertile ground for a child to ask more questions (Frazier et al., 2009; Yu, Bonawitz & Shafto, 2019; Yu, Landrum, Bonawitz & Shafto, 2018).

Despite the importance of adult explanations in children's acquisition of important world knowledge, many adult explanations do not always adequate information to support children's conceptual understanding. There are a variety of reasons why this occurs. As any parent can attest, often caregivers lack the time or energy required to provide an adequate explanation in answer to a young child's frequent questions. In other cases, the caregiver might not have the background or confidence in their knowledge to attempt an answer to complex questions like "Why are there bubbles in my bath?" or "Why does it get dark at night?" Finally, some caregivers may not feel that it is developmentally appropriate to respond to young children's questions with complex answers (Crowley et al., 2001; Gauvain et al., 2013; Shulman & Checa, 2017; Valle, 2009). In any of these circumstances, there are a variety of ways that the caregiver might respond to a child's question—by ignoring the question, by responding without answering the question (e.g., "Don't worry about that"), or by responding with circular logic (e.g., "Because it does" or "Just because").

Even young children are capable of discerning between the types of adult responses described in the previous paragraphs, making inferences about the types of responses they privilege and about the speakers themselves (Corriveau & Kurkul, 2014; Corriveau, Kurkul & Arunachalam, 2016; Mercier, Bernard & Clément, 2014). In a recent study (Kurkul & Corriveau, 2018) we investigated the question-asking behavior of children from different socioeconomic backgrounds. Using a sample of 37 low- or mid-SES parent-child dyads from the CHILDES database (Mchildeg = 48 months), we investigated if there were differences by socioeco-

conomic status in the number and type of information-seeking questions asked by children, the responses given by caregivers, and the nature of children's response to the explanation given. We found that there were no differences across social class backgrounds in the type of questions asked (fact-based vs. causal) or the proportion of utterances which were questions. However, the overall number of questions proposed by low-SES children was almost half the overall number proposed by children in mid-SES dyads. Further, we found that children in mid-SES families were much more likely to hear an explanation that provided new information to answer their question—a finding we suggest may be 1 reason why children from mid-SES are more likely to ask questions.

The studies mentioned above primarily focused on the dyadic exchange between children and their caregivers in the home context. These exchanges are markedly different than those that take place in classroom settings. Given that classrooms may have 1 teacher for approximately 25 students, exchanges are often initiated by the teacher and do not always provide children with the opportunity to elaborate or extend their query with question-asking. Moreover, when children enter formal schooling, their rate of question-asking decreases significantly – from a rate of 26 per hour when interacting with their parents, to rate of only 2 per hour at school (Tizard & Hughes, 1984). Indeed, observational work by Engel (2011) indicates that children's questioning interactions continues to decrease between the kindergarten classroom and 5th grade. Such changes in information-seeking likely occur because children have adapted their strategies for acquiring information to meet the demands of formal schooling. This adjustment should not undermine the value of the exchange between the teacher and the student. Indeed, research has shown that teacher elicitations and extensions in conversations and book reading experiences with preschoolers are associated with vocabulary growth (Cabell, Justice, McGinty, DeCoster & Forston, 2015; Dickinson & Porsche, 2011; Zucker, Cabell, Justice, Pentimonti & Kaderavek, 2013). Although initiated by the teacher, these interactions provide children with the opportunity to ask follow-up questions and extend queries to deepen their own learning. Moreover, research has shown that during small group instruction with preschoolers, more syntactically complex utterances used by teachers are associated with children's own use of syntactically complex utterances (Zucker et al., 2013). As these studies suggest, exposure to rich language environments in preschool yield lasting benefits.

When children begin formal schooling, there are expectations for how they will use language to learn, present information, and interact with their teachers and peers. For some children, these expectations have been inculcated in them from a very early age by parents who use these methods of learning and communication and have socialized their children to use language in ways that dovetail with the expectations of the school. For many other children, the expectations about how language is used to get things done in school contrasts with the way that they have learned to use language in their family and community (Moore & Schlepppegrell, 2014). In her ethnographic research, Heath (1983) demonstrated how differences in the ways that communities value and use language differentially socializes children in how language is used. These differences have also been observed in more recent ethnographic work by Sperry, Sperry and Miller (2019), who showed considerable variation in language environments within communities across the socioeconomic stratum. In their study, Sperry et al. refuted previous findings that suggest a “30-million-word gap” exists between children from low-SES and mid-SES families during the early years of life. Instead, they posited children across socioeconomic stratum may be exposed to different patterns of talk, multiple caregivers and bystander talk that is not adequately represented in how researchers estimate the number of words a child is exposed to. Together, Heath and Sperry's findings

support our hypotheses that there will be variability in the question, explanation, follow-up pattern of interaction across economically diverse preschool classrooms.

One of the most comprehensive descriptions of the “language of schooling” in recent years has been the concept of academic language (Schlepppegrell, 2004; Snow, 2010; Uccelli, Demir-Lira, Rowe, Levine & Goldin-Meadow, 2019). The concept stems from the theory of Systemic Functional Linguistics (SFL) that posits that there are specific lexical, textual, and grammatical choices made by a speaker when speaking about school subjects in the context of formal schooling (Halliday, 1993; Scheele, Leseman, Mayo & Elbers, 2012; Schlepppegrell, 2004). Language used in an academic language register includes talk that is decontextualized, complex in content, includes interconnected and linear statements, and positions the speaker as expert (Snow & Uccelli, 2009). This language register is different from typical face-to-face communication and children are generally expected to be facile in communicating within this register from the time they enter kindergarten (Scheele et al., 2012; Schlepppegrell, 2004). Further, children's competence in using academic language is positively related to several academic outcomes (De Jong & Leseman, 2001; Dufva, Niemi & Voeten, 2001; Fang, Schlepppegrell & Cox, 2006; Nation & Snowling, 2004; Savolainen, Ahonen, Aro, Tolvanen & Holopainen, 2008; Uccelli et al., 2019).

Developing facility with academic language is expected by the time children enter kindergarten. However, in the preschool years, teacher talk rarely follows the conventions of ‘academic language’ as noted above. In fact, most exchanges typically occur in whole groups where the goal is to provide children with directions and consequently use less academic language than is observed in whole group instruction during the later grades (Booren et al., 2012; Dickinson, 2011). Yet, it is still important to consider that exchanges between teachers and preschoolers do occur outside of whole group instruction. Indeed, a one-to-one exchange during free play, dramatic play etc. may provide a rich opportunity for even the youngest of learners to be exposed to markers of academic language (e.g., grammatical choices made by the speaker such as syntactic complexity).

Whereas a body of literature focuses on children's ability to produce and comprehend the type of academic language described above, we could find no mention in the literature regarding the relationship between children's ability to ask questions, learn from explanations, and academic language. Most of the literature focuses on children's ability to produce and comprehend academic language (e.g. De Jong & Leseman, 2001; Dufva et al., 2001; Fang et al., 2006). However, it is theoretically plausible that children's ability to ask questions and learn from high-quality responses is an important feature of engaging in academic discourse. Indeed, entire curricula in early childhood are devoted to inquiry, wherein children are expected to ask questions as the driving force in their learning (Edwards, 2002; Gandini, 1993). If children's ability to ask questions and learn from high-quality responses can be considered a component of the academic language register that is valued and expected in school, then it follows that this ability would be associated with children's school success.

In the current study, we ask 3 main research questions. First, are there differences in the types of questions children ask in preschool settings across diverse socioeconomic settings? Research has highlighted differences in the overall number of questions preschoolers ask to their caregivers (Kurkul & Corriveau, 2018) but; the relative proportion of question-asking types was quite similar across family SES (Kurkul & Corriveau, 2018). Therefore, we anticipated that although there might be differences in the overall number of questions, the relative proportion of information-seeking questions preschoolers posed to their teachers should be similar across settings. Second, we ask about potential differences

in the types of responses teachers provide to children's questions across diverse socioeconomic settings. In this sample, all teachers possessed a minimum of an Associate degree and were certified Early Childcare providers. Thus, on the 1 hand we expected to observe similar approaches to answering children's questions. However, because of the socioeconomic diversity in the sample we also predicted that cultural norms and values around questions may be associated with variability in teacher responses. Finally, we asked about differences in the types of follow up responses children offer to teachers' responses. Specifically, we focused on children's responses to teacher responses that did not provide a sufficient explanation. Arguably, if children are using questions as a mechanism to learn from others, then we anticipate differences in the follow up to responses that do not provide an explanation to the child's question as compared to responses that do provide an explanation.

2. Method

2.1. Sample

Twenty videos comprising 10 low-SES preschool classrooms and 10 mid-SES preschools classrooms from 11 distinct schools were used (age range 3–5 years-old; $M_{\text{class size}} = 18$ children). SES was determined using both demographic survey data and the median income of households in the community where the preschool resided (census.gov) based on the assumption that people tend to find childcare settings in the community where they reside. Nevertheless, we acknowledge that other factors such as proximity to workplace may influence where a caregiver decides to send their child for childcare (Tang, Coley & Votruba-Drzal, 2012). Demographic survey data from 75% of families indicated that 82% of families from the preschools from low-income areas reported earning less than \$25,000.00 and 96% reported earning less than \$70,000.00 a year. In comparison, 94% of the families from the preschools from mid-income areas reported earning more than \$80,000.00 a year. It should also be noted that all but 1 of the low-SES schools were publicly funded (Head Start) while all the mid-SES schools were private.

Videos came from a larger language-based study where teachers were told that researchers were interested in exploring ways that early childhood teachers support children's language development. Inclusion for this study was based on accessibility to the research institution, the preschool's inclusion in a statewide quality rating system, SES and teachers' willingness to participate. Teachers were given professional development credits for their participation. Three classrooms used the Creative Curriculum while the remaining 17 classrooms did not adopt a published and/or prescribed curriculum. The classrooms had similar setups, schedules (e.g., circle time, snack time, free play, etc.), and routines. The classrooms included areas for distinct types of play (e.g., blocks, dramatic play, and books) (See Table 1 for demographic characteristics of children).

The videos were comprised teacher and student interactions. All classrooms included 2 teachers (a lead and an assistant) and were video recorded at 3 different time points for approximately 30 min per classroom (90 min total). During these 30 minute segments, students engaged in free play, snack time and direct instruction (circle time or center-based). Because the study primarily focused on the lead teacher, she wore a lapel microphone that was wirelessly connected to the camera. Camcorders were strategically placed in the classroom so that the lead teacher and students could be observed (note: an experimenter or other classroom teacher moved the camcorder when the lead teacher transitioned to a new activity). Note, children did not wear microphones. Children's speech was detected via the teacher's microphone. All teachers possessed a minimum of an Associate degree. Addition-

ally, the number of years of education did not significantly differ between teachers in low-SES and mid-SES classrooms ($\chi^2(1, N = 20) = 4.26, n.s.$) (See Table 2 for demographic characteristics of Educators).

2.2. Procedure and coding

Videos were transcribed by trained research assistants. To ensure accuracy of the transcriptions, 60% of the transcripts were checked against the original video. We searched for child utterances (any single or multi word phrase spoken by a child or teacher) that included question words ("who" "where" "what" "when" "how" "did/do" "should" as well as phrases associated with close-ended yes/no questions). This resulted in 350 child-initiated questions. Note, because we were interested in children's use of questions as a mechanism for learning, each exchange began with a child-initiated question. The coding scheme which was adapted from Kurkul and Corriveau (2018) consisted of 3 steps of an exchange: initial question, teacher's response (non-explanatory vs. explanatory), and the child's follow-up reaction. An exchange was considered complete at the beginning of a new exchange. Note, because multiple children were present during the exchanges, there was not always an opportunity for children to follow-up with the teacher. Thus, exchanges where another student interjected were coded as 'child's follow up incomplete.' Two independent researchers coded each transcript. Inter-rater reliability for each step of the exchange was high (questions $\kappa = 0.95$; teacher response $\kappa = 0.88$ and child follow up $\kappa = 0.92$). Disagreements were reconciled through discussion between coders. Note, in all examples we have included the participant ID (P#) and line number on the transcript of the utterance (L).

CHILD((question): 'Why's a penguin right there?' (P# 9B, L10)

TEACHER (response): 'Because she made a project with snow and penguins live in snow' (P# 9B, L11)

CHILD (follow-up): 'So she made a picture?' (P# 9B, L12)

Child's questions were coded as information seeking, or non-information seeking. Information seeking questions comprised both fact-based and causal questions while non-information seeking comprised action seeking, and permission seeking. Fact-based questions were those that could be answered with simple 1 word responses or direct statements (e.g., mostly what, where or when questions; 'What is that?') whereas causal questions are those that required more elaborate responses (e.g., mostly how or why questions; 'Why is there a penguin?'). Action seeking questions elicited an action response from the teacher (e.g., 'Can you give it back to me?') whereas permission seeking questions sought approval from the teacher to complete an action (e.g., 'Can I go?').

Next, we coded teachers' responses to children's questions. Of the 350 questions that were asked, teachers responded with 618 utterances. Teacher's responses were coded across 6 categories (a) response on topic, no explanation needed; (b) response on topic, with explanation; (c) response on topic, no explanation; (d) response unrelated; (e) turns the question back (Chouinard et al., 2007); and (f) no response. Below we describe each response type in more detail.

On topic, no explanation needed. We assigned this code when the teacher provided a response that related to the original question. The original question (typically, fact-based questions, or close-ended questions) was able to be answered with a single utterance, therefore these responses were coded as on topic no explanation needed. Note, because causal questions typically require an explanation, this category was removed from analysis when categorizing responses to causal questions.

CHILD (question): 'Is that a hat?' (P #11C, L, 22)

TEACHER (response): 'Yes' (P #11C, L, 23)

Table 1
Characteristics of Classrooms by SES.

	Educator ID	Curriculum Used	Age Range of Children in Class	Mean Age of Children in the Class in Months Mean (SD)	Approximate Number of Children in Class
<i>Low-SES</i>	4A	Creative Curriculum	3–5 years	50.14 (8.48)	16–20 children
	4B	Creative Curriculum	3 ½–5 years	49.77 (7.40)	16–20 children
	4C	Creative Curriculum/Teaching Strategies Gold	3–5 years	47.64 (6.42)	16–20 children
	4D	Creative Curriculum/Teaching Strategies Gold	3–5 years	50.06 (7.60)	16–20 children
	3B	NA	3–4 ½ years	48.92 (5.44)	16–20 children
	13D	No published curriculum	3–5 year olds	46.88 (5.43)	16–20 children
	14A	No published curriculum	3–5 year olds	57.10 (6.32)	7–10 children
	14B	No published curriculum	3–5 year olds	52.68 (8.23)	7–10 children
	15A	No published curriculum	3–5 year olds	48.36 (5.67)	16–20 children
	16A	No published curriculum	3–5 year olds	49.20 (5.27)	16–20 children
<i>Mid-SES</i>	9B	No published curriculum	3–4 1/2 years	42.71 (7.14)	16–20 children
	9C	No published curriculum	4–5 years	62.85 (6.33)	16–20 children
	10A	No published curriculum	5–6 year olds	70.83 (3.27)	7–10 children
	10C	No published curriculum	4–5 year olds	57.54 (2.96)	7–10 children
	11B	No published curriculum	4–5 year olds	57.54 (2.96)	16–20 children
	11 C	No published curriculum	3–5 year olds	51.35 (9.22)	15–20 children
	11 E	No published curriculum	3–5 year olds	54.63 (6.85)	18–20 children
	12 A	No published curriculum	3–5 year olds	60.84 (4.48)	16–20 children
	12 B	No published curriculum	3–5 year olds	41.82 (8.67)	16–20 children
	13 C	No published curriculum	3–4 year olds	39.23 (7.23)	7–19 children

Table 2
Demographic Characteristics of Educators by Classroom SES.

	Educator ID	Age Range in Years	Range of Experience as Lead Preschool Teacher in Years	Race/Ethnicity	First Language	Highest Degree Earned
<i>Low-SES</i>	3B	40–49	NA	Hispanic/Latino/a	Spanish	NA
	4A	26–30	7–9	Hispanic/Latino/a	Spanish	Associate's Degree
	4B	31–39	7–9	Other	Bilingual in English and Albanian	Bachelor's Degree
	4C	≤20	1–2	Hispanic/Latino/a	Spanish	Associate's Degree
	4D	26–30	1–2	Mixed Race	English	Associate's Degree
	13D	31–39	7–9	White	English	Bachelor's Degree
	14A	40–49	16–20	White	English	Bachelor's Degree
	14B	50–59	≥21	White	English	Bachelor's Degree
	15A	26–30	1–2	Hispanic/Latino/a	Spanish	Associate's Degree
	16A	31–39	3–5	Hispanic/Latino/a	Bilingual	Bachelor's Degree
<i>Mid-SES</i>	9B	31–39	16–20	White	English	Bachelor's Degree
	9C	40–49	≥21	White	English	Master's Degree
	10A	50–59	≥21	White	English	Bachelor's Degree
	10C	50–59	≥21	White	English	Associate's Degree
	11B	40–49	≥21	White	English	Master's Degree
	11 C	26–30	3–5	White	English	Bachelor's Degree
	11 E	31–39	16–20	White	Bilingual (English/Russian)	Bachelor's Degree
	12 A	31–39	7–9	White	English	Bachelor's Degree
	12 B	26–30	3–5	White	English	Bachelor's
	13 C	26–30	1–2	Hispanic/Latino/a	Bilingual (Spanish/English)	Associate's Degree

On topic with explanation. This code was used when the teacher provided a response that contained an explanation. Explanations were defined as statements that provided the reason or cause of something. These types of responses were typically coded following causal questions

CHILD (question): ‘Why did the ball roll away?’ (P #16a, L 8)
TEACHER (response): ‘It rolled away because you pushed it and it moved down the table’ (P #16a, L 9)

On topic no explanation. On numerous occasions, teachers responded to children’s causal questions with statements that did not include an explanation even though 1 was requested. In these cases, we coded responses as on topic, no explanation.

CHILD (question): ‘How does the bus door open?’ (P #14, L 25)
TEACHER (response): ‘It has a door that opens’ (P #14, L 26)

Response unrelated. A response was coded as unrelated when the teacher responded to a child’s question with an off-topic remark.

CHILD (question): ‘What is in the sky?’(P #4a, L 78)
TEACHER (response): ‘It is time to go inside’ (P #4a, L 79)

Turns question back. We coded responses as turns question back when the teacher responded to the child’s initial question by restating the question to encourage the child to generate a response to her own question.

CHILD (question): ‘Why do I need to put glue on it?’ (P #3, L 47)
TEACHER (response): ‘Why do you think it needs glue?’ (P #3, L 48)

The final part of the exchange that we coded was children’s follow-up reactions. Only 71 of the 350 exchanges included a child’s follow-up reaction. Follow-up reactions were coded as (a) repeats original question, (b) asks a follow-up question (c) repeats teacher’s explanation (d) provides own explanation (e) incomplete exchange. We provide more details about these responses below. Recall, that multiple children were present during each exchange, likely reducing the opportunity for a child to follow-up to a teacher’s reaction. We explore the implications of this further in the discussion.

Repeats original question. This code was used when a child repeated the original question that initiated the exchange. Note, cases where a child repeated their original question immediately following the initial question (because no response from the teacher was given) were coded as repeats original question (this occurred 3 times across all transcripts).

CHILD (question): ‘What is in the box?’ (P #10a, L 54)
TEACHER (response): ‘What do you think is in the box?’ (P #10a, L 55)

CHILD (follow-up): ‘Tell me, what is in the box?’(P #10a, L 56)
Asks a follow-up question for elaboration. This code was used when a child reacted to the teacher’s response with a new question (different from the original question).

CHILD (question): ‘Why does the blocks go there?’ (P #12b, L 30)

TEACHER (response): ‘Because they need a big shelf so they all fit’ (P #12b, L 31)

CHILD (follow-up): ‘Is the shelf big enough for all the blocks?’ (P #12b, L 32)

Repeats teachers’ explanation. This code was assigned when the child repeated the teacher’s response to the initial question.

CHILD (question): ‘Why did the balloon do that?’ (P #12c, L 14)
TEACHER (response): ‘It went in the air because all the air came out of the balloon’ (P #12c, L 15)

CHILD (follow-up): ‘The air came out of the balloon so it went up’ (P #12c, L 16)

Table 3
Frequency of questions asked (percentage) by question type and school socioeconomic status (mid-SES, low-SES).

	Mid-SES	Low-SES	Total
<i>Information seeking</i>			
Fact-based	92 (38.3%)	38 (34.5%)	130
Causal	27 (11.25%)	10 (9%)	37
<i>Non-information seeking</i>			
Permission seeking	57 (23.75%)	34 (30.1%)	91
Action Seeking	64 (26.67%)	28 (25.5%)	92
Total	240	110	350

Provides own explanation. We coded follow-up as provides own explanation when the child created their own explanation/response to the initial question.

CHILD (question): ‘What is the house on there for?’ (P #13D, L1)

TEACHER (response): ‘She drew it on her paper’ (P #13D, L2)

CHILD (follow-up): ‘It’s because she loves pretty pink houses with windows’ (P #13D, L 3)

3. Results

The results section is organized as follows. First, we focus on our first research question – namely, potential differences in the types of questions children ask in preschool settings across diverse socioeconomic settings. Second, we explore potential differences in the types of responses teachers provide to children’s questions across diverse socioeconomic settings. Finally, we ask about potential differences in children’s follow up to their teachers’ responses – especially when those responses do not provide an answer to their questions – across diverse socioeconomic settings.

To answer these questions, and to be consistent with child language data analytic techniques, the data were pooled across children, making the utterance instead of the child the basic unit of analysis. This strategy has been used across multiple studies (e.g., Bartsch et al., 2003; Frazier et al., 2009; Frazier, Gelman & Wellman, 2016) and meets the requirement of independence needed to conduct statistical analyses as defined by Bakeman and Gottman (1997) who suggest that utterances measured in naturalistic settings are considered independent as long as separate coding decisions are made for each individual event and the coding categories are mutually exclusive. Both conditions applied to the coding scheme that was used. To ensure that the results were not driven by any particular classroom, we followed a multistep analysis plan. We first conduct chi-square tests (e.g., crossing SES with 1 of the 3 question exchange types). When significance was found, we also compare the proportion of each individual category by group using z tests (see also Kurkul & Corriveau, 2018). Finally, as an informal assessment of the potential nesting effects, we report the number of classrooms in each group who displayed a pattern consistent with the pattern found for the overall group. Results are reported below.

3.1. Children’s questions

3.1.1. Are there differences in the types of questions children ask in preschool settings across diverse socioeconomic settings?

Table 3 displays the total number of questions by socioeconomic background (low-SES, mid-SES) and question type. Similar to previous findings (Kurkul & Corriveau, 2018), children in low-SES classrooms asked fewer questions compared to children in mid-SES classrooms (110 vs 240, binomial test, $P < 0.05$) Despite differences in the number of questions children asked, a similar pattern emerged when exploring the proportion of the types of questions asked by children. Indeed, both groups asked

Table 4
Teachers' Responses to Fact-Based and Causal Questions by Socioeconomic Status (SES).

	No Explanation Needed	No explanation	With Explanation	Turns Question Back	Response Unrelated	No Response	Total
<i>Response to Fact Based Questions</i>							
Mid-SES	114 (62.6%)	0 (0%)	22 (12.08%)	22 (12.08%)	10 (5.5%)	14 (7.7%)	182
Low-SES	32 (56%)	0 (0%)	5 (8.77%)	11 (19.29%)	5 (8.77%)	4 (7%)	57
Total	146	0	27	33	15	18	239
<i>Response to Causal Questions</i>							
Mid-SES	N/A	3 (4.1%)	42 (56.8%)	27 (36.5%)	0 (0%)	2 (2.7%)	74
Low-SES	N/A	5 (17.9%)	17 (60.7%)	4 (14.3%)	0 (0%)	2 (7.1%)	28
Total	0	8	59	31	0	4	102

Note: No explanation needed was only included as a category for responses to children's fact-based questions.

In several cases teachers gave multiple responses to the same question which accounts for why there are more responses than questions.

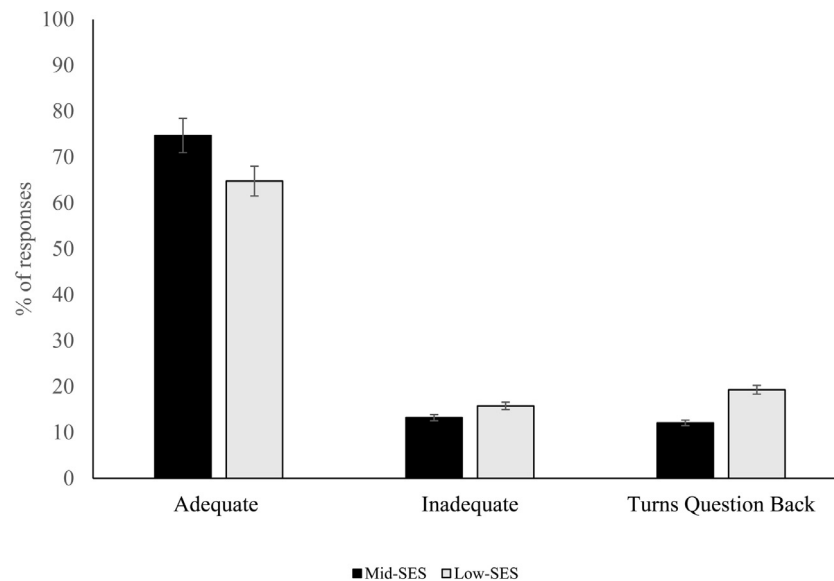


Fig. 1. Percentage (standard error, SE) of teachers' responses to fact-based questions by response type and socioeconomic status.

non-information seeking questions more frequently (55.6% low-SES; 50.54% mid-SES) than information seeking questions (44.4% low-SES; 49.5% mid-SES). The larger proportion of non-information seeking questions is likely a result of the school context, where students are required to seek permission and actions from teachers to engage in particular activities.

3.2. Teacher's responses to Information- Seeking Questions

3.2.2. Are there differences in the types of responses teachers provide to children's questions across diverse socioeconomic settings?

Recall, information seeking questions were either coded as fact-based or causal. Given that fact-based questions can often be answered with non-explanatory responses (unlike causal questions which require explanations), we chose to explore responses separately.

Teacher's responses to fact-based questions. Inspection of Table 4 indicates that teachers from low-SES schools and mid-SES classrooms provided a similar pattern of responses to fact-based questions whereby the majority of responses were categorized as *on topic, no explanation needed* (56% and 62.6%). Given the nature of these questions, it is likely teachers did not need to provide elaborate explanations. To confirm the similarity across the 2 groups, we conducted an omnibus chi square where we crossed SES with response type; $\chi^2 (4, N = 239) = 2.57, ns$.

To evaluate the extent to which adult responses adequately addressed children's questions, we collapsed across responses to fact-based questions to create 3 new categories (a) Adequate re-

sponse (combining the *on topic with explanation* and the *on topic, no explanation needed* categories, as both responses addressed the child's question), (b) Inadequate response (combining the *on topic, no explanation, response unrelated*, and *no response* categories) (c) Turns questions back. Arguably, providing an explanation or an on-topic response when no explanation is needed can be seen as an adequate response to a child's fact-based question. Responses that consisted of an unrelated explanation or no response can be viewed as inadequate responses. We viewed turns question back as 'neutral' responses. On the 1 hand 'turns-question back' responses might encourage children to explore a topic further, as in inquiry-learning settings; on the other hand, turning the question back did not provide new information to the child, and might be interpreted as a way to terminate the conversation. Inspection of adequacy reveals that both low-SES and mid-SES teachers responded to children's questions similarly. Indeed, most responses were adequate (included an explanation or were on topic but no explanation was needed) (64.77% vs 74.68% respectively), ($\chi^2 (1, N = 173) = 1.84, ns$) (Fig. 1). When examined separately, 18 of the 20 low-SES teachers and 19 of 20 mid-SES teachers and followed the same response pattern.

Teacher's responses to causal questions. Next we explored teachers' responses to causal questions. Table 4 shows responses to causal questions by school type (low-SES, mid-SES). Unlike previous studies which showed differences by SES in home-based contexts (Kurkul & Corriveau, 2018), there were no significant differences in the types of responses teachers gave to causal questions $\chi^2 (3, N = 102) = 3.72, ns$. In fact, across both low-SES and mid-

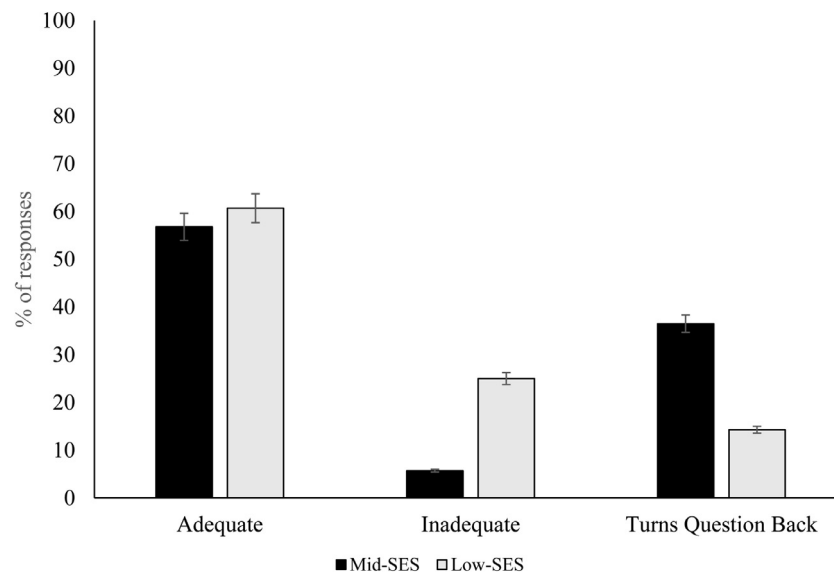


Fig. 2. Percentage (standard error, SE) of teachers' responses to causal questions by response type and socioeconomic status.

Table 5

Children's follow-up to teacher's inadequate responses by socioeconomic status (low-SES; mid-SES) and initial question type (fact-based/causal).

	Repeats Original	Follow-up elaboration	Repeats Explanation	Own-explanation	Incomplete Exchange
<i>Follow-Up Fact Based Questions</i>					
Mid-SES	13 (54.17%)	4 (16.67%)	1 (4%)	3 (12.5%)	3 (12.5%)
Low-SES	5 (55.56%)	2 (22.22%)	1 (11.11%)	0	1 (11.11%)
<i>Follow-Up Causal Questions</i>					
Mid-SES	2 (28.57%)	0	0	3 (42.85%)	2 (28.57%)
Low-SES	2 (40%)	1 (20%)	0	0	2 (40%)

SES classrooms that majority of responses to causal questions were on topic and contained an explanation (60.7% and 56.8% respectively).

To evaluate the extent to which adult explanation adequately responded to the children's causal questions, we collapsed teachers' responses into 3 categories: (a) Adequate response: (*on topic, with explanation*), (b) Inadequate response: (combining *on topic, no explanation, no response, and response unrelated* categories), (c) Turns question back. Note, because all causal questions require an explanation we removed the *on topic, no explanation needed* category that was used when exploring the quality of fact-based responses. Fig. 2 illustrates differences in the combined no explanation category and turns question back between the 2 groups. To confirm these differences, we performed an omnibus chi-square χ^2 (2, $N = 102$) = 9.1, $P = 0.01$. Follow up analyses revealed statistically significant differences in the Inadequate responses (6.8% vs 25%; $z = 2.55$, $P = 0.01$) and turns question back (36.5% vs 14.3%; $z = 2.18$, $P = 0.03$). Whereas teachers in low-SES preschools were more likely to provide an inadequate response, teachers in mid-SES preschools were more likely to turn questions back to the child.

3.3. Children's follow up

3.3.1. Are there differences in children's follow up to their teachers' responses to their questions across diverse socioeconomic settings?

We first began by exploring children's follow-up to responses based on the initial question they asked (follow up to a teacher's response to a fact-based question vs. follow up to a teacher's response to a causal question) (Table 5). Note, there were too few responses to analyze statistically, but visual inspection of Table 5 reveals that children offered several follow-up responses ($N = 45$). When children did offer a follow-up response, they tended to persist when they did not receive a response that sufficiently pro-

vided an explanation to their questions, albeit with various strategies. For fact-based questions, the most common follow-up strategy used by all children was to repeat their original question. By contrast, for causal questions, the follow-up strategies used by children varied by socioeconomic status. Children attending preschools in low-SES neighborhoods were most likely to repeat their original question, whereas children attending preschools in mid-SES neighborhoods were most likely to provide their own explanation. Indeed, inspection of the follow-up strategies for both fact-based and causal questions indicates that children attending preschool in low-SES neighborhoods never chose to provide their own explanation.

4. Discussion

This study examined the question, response, follow-up pattern of interaction that young children often use to acquire conceptual knowledge in diverse classroom settings. Our discussion focuses on 3 key findings. First, children across diverse socioeconomic settings ask similar types of questions in the preschool classroom context. Second, teachers from mid-SES classrooms are more likely to turn causal questions back to children than teachers in low-SES classrooms. Third, when teachers provided responses that did not completely answer the child's question (turned question back, offered no explanation, no responses or an unrelated response), tentative results suggest that children in low-SES were more likely to repeat their original question while children from mid-SES classrooms responded with their own explanation more. We expand on these findings and discuss implications below.

4.1. Children's questions

Taken together, the findings suggest that children across diverse socioeconomic settings use questions to engage adult learn-

ing partners in classroom-settings. Although the majority of questions asked by children in low-SES classrooms and children in mid-SES classrooms were non-information-seeking questions, a large proportion were information-seeking. This pattern is consistent with research examining the types of questions asked by children across diverse socioeconomic backgrounds in home-based contexts (Callanan, Solis, Castañeda & Jipson, 2020; Chouinard et al., 2007; Kurkul & Corriveau, 2018; Ronfard et al., 2018).

4.2. Teachers' responses

However, findings from this study diverge from previous studies of home-based contexts when considering variability in adult responses to children's questions. Previous work exploring parent-child exchanges in home-based contexts found differences between low- and mid-SES dyads in the quantity of questions asked by the child, the types of responses to children's questions (low-SES parents provide fewer explanations than mid-SES parents) and children's follow-up behaviors. In the current study, although the majority of adult responses to children's fact-based questions in both mid- and low-SES classrooms were non-explanatory, teachers in both low-SES and mid-SES classrooms typically responded to causal questions with explanations. This finding is encouraging, as preschool teachers may be working to expose all children to a discourse pattern that is often used in formal schooling as a means to acquire conceptual knowledge—thereby preparing children from all backgrounds to participate in and benefit from the discourse of formal schooling.

Despite the similarity in talk that was observed between the 2 classroom types, teachers exhibited differences in their use of the “turns question back” strategy. Indeed, teachers from mid-SES classrooms turned causal questions back significantly more than teachers from low-SES backgrounds. Children from mid-SES classrooms were more likely to respond to having the question turned back to them by generating their own explanation, whereas children from low-SES classrooms were more likely to respond by repeating their original question. This finding is consistent with recent work exploring differences in how parents use questions as a pedagogical tool. Yu et al. (2019) found that mid-SES parents use the strategy of turning the question back significantly more than low-SES parents. On the 1 hand, because this pattern is modeled in the home, teachers and children in mid-SES classrooms may feel more comfortable engaging in this discourse pattern. On the other hand, children in mid-SES classrooms may not prefer this type of response, as it has been shown that children from mid-SES backgrounds prefer specific types of explanations (e.g., those that employ passive voice, non-circular etc.; Kurkul & Corriveau, 2018; Leech, Haber, Arunachalam, Kurkul & Corriveau, 2019). Additionally, although this strategy is observed in both home contexts as well as classroom contexts, it remains unclear how this language pattern affects the academic register. Thus, future work should explore how an inquiry-learning strategy focusing on turning the question back instead of providing an explanation in response to the child's question is related to children's developing academic register. Lastly, these responses may be predicted by the teacher's own ethnotheories about when it is appropriate to provide explanations versus turning the question back. Indeed, some teachers subscribe to methods that rely heavily on inquiry-based learning – thus, it is their daily practice to turn questions back to students (Edwards, 2002; Gandini, 1993; Haber et al., under revision). Future research should explore individual differences such as how teachers' cultural background and epistemological beliefs influence the ways in which they approach question-explanation exchanges with young learners.

4.3. Children's follow up

The findings from the current study also revealed differences in the strategies used by children when following-up to teachers' responses to their questions. As hypothesized, if in fact children are using questions to acquire new information, then they will likely persist when they receive a response that does not include an on-topic answer or an explanation when appropriate. Note, these findings are based on visual inspection of frequencies and should be interpreted with caution as they were collapsed across question type and response type. We found that when children did offer a follow-up response, they tended to persist when they did not receive an explanatory response to their question, albeit with various strategies. For fact-based questions, the most common follow-up strategy used by all children was to repeat their original question. By contrast, for causal questions, the follow-up strategies used by children varied by socioeconomic status. Children from low-SES backgrounds were most likely to repeat their original question, whereas children from mid-SES backgrounds were most likely to provide their own explanation. On the 1 hand, children's creation of their own responses encourages children to use reasoning skills. However, if the explanation they derive is incorrect, it may have long term consequences for their conceptual understanding. Thus, it is important for educators to attend to the accuracy of the explanations children generate on their own. Moreover, if these trends prove significant in future research, it could provide insights into the ways in which children across diverse backgrounds may or may not be using questions as a mechanism to learn from others.

It is also important to consider plausible consequences for children's follow up where they repeat their original question – a pattern observed most frequently in children from low-income classrooms. It can be argued that this follow-up type indicates a child's desire to continue exploring or engaging with a teacher about a topic (Legare, 2014). There are a few possible explanations for the phenomena. Perhaps this follow-up type indicates a child's desire to continue exploring or engaging with a teacher about a topic – that it serves as a sort of communicative bid. It is also possible that repeating the original question is a behavior that has previously produced desired results, either at home with their caregiver or in the classroom with this teacher and is therefore repeated. Finally, it is also possible that expressive language skills limit the number of ways the child can easily formulate her question. Additionally, it is also plausible that there was a mismatch between children's SES and teachers' SES as well as children's L1 and teacher's L1 (note 7 of the 20 teachers identified as bilingual). Previous work looking at children's responsiveness to teachers notes that “passive teacher effects” (e.g., race and ethnicity) plays a critical role in children's interactions (Dee, 2004). Given that our sample of teachers in both low-SES and mid-SES classrooms are considered mid-SES (based on their Education level), it is possible that children's responses varied because of this mismatch in pairing (low SES student with mid SES teacher). Indeed, more work is needed to understand what a repeated question garners a child in a preschool classroom.

In some cases, exchange patterns were incomplete because children did not have the opportunity to follow-up. Most of the time this occurred because the teacher moved on to an interaction with a different child. Literature exploring children's question asking in formal schooling suggests that children ask considerably fewer questions in formal-schooling contexts (Engel, 2011; Heath, 1983; Tizard & Hughes, 1984). We surmise that experience in early childhood classrooms where children do not always receive responses to their questions – and they are not able to follow up – likely contributes to this lack of questioning. Future research should focus on children's question-asking behavior over time to explore the relation between teacher's responses and children's subsequent questioning in the classroom.

4.5. Limitations

Despite the many strengths of this study, it is important to note several limitations. Specifically, we explored a relatively small sample of 20 preschool classrooms. Therefore, we must interpret our conclusions about socioeconomic variability with caution. Indeed, the lack of significant differences between the 2 groups may be attributed to this relatively small sample size. Additionally, variability may have been due to child level factors that were not measured in this study. Indeed, it is plausible that some children did not possess the prerequisite skills needed to engage in the exchange pattern observed in this study. Thus, future work should consider individual differences that may contribute to children's question asking and follow up behaviors. Additionally, variability in teacher demographics (e.g., training, linguistic background, teacher SES etc.) may have influenced teacher responses. In particular, child and classroom SES characteristics may be confounded by the fact that most of the lower SES sites were Head Start classrooms, which have a distinct culture and set of expectations (relative to another private preschool site serving children of the same SES background). More work is needed to pinpoint specific teacher characteristics that influence how they respond to student queries. Finally, the classroom is an incredibly dynamic context. Indeed, most of the recorded interactions occurred during whole group time where perhaps teachers did not turn questions back as much as they could have or provided limited responses because of the context. Additionally, there may have been opportunities for children to engage in question asking that were not captured using a single camcorder. Specifically, peer interactions in the classroom also provide unique opportunities for learning. Future studies may consider focusing on how preschoolers use questions with their peers as a mechanism for learning.

Although these findings come from a relatively small sample, they provide preliminary insights into the potential role that early schooling contexts play in providing children from all socioeconomic strata opportunities to engage in dialogic exchanges that are valued in formal schooling and can be a rich source of critical conceptual knowledge. By presenting young children with explanations to causal questions, preschool teachers not only help children acquire new knowledge, but also expose them to explanatory structures and discourse patterns that they might not otherwise be exposed to in their home-context. These structures are pervasive in formal schooling and the findings from the current study suggest that this pattern is consistently followed across diverse groups which is highly encouraging.

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