

Online Environments Not a Barrier to Preschoolers Questions about Unknown Words

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Abstract

When preschoolers encounter a new word and word meaning, they can quickly link the two items to learn a new word. When not provided with the necessary items to learn a word, preschoolers will drive their own word learning. Previous research revealed that 5-year-olds asked more questions about unknown words than known words, highlighting their active word learning (Janakiefksi et al., 2022). However, it is unclear whether 5-year-olds' active word learning extends to online environments—a crucial question given the growing role of online environments in young children's daily lives. To investigate 5-year-olds' online active word learning, the current study replicated the procedure in Janakiefski et al. (2022) via Zoom. We instructed participants to move their toys according to 9 known and 9 unknown target action words and recorded participants' questions about word meanings. Online participants ($n = 19$) asked more questions about unknown words than known words. Across online and in-person environments, we found no differences in 5-year-olds' ($n = 38$) pattern of question-asking about word meanings. We did find some differences in the types of questions about word meanings that 5-year-olds produced across environments. In-person participants asked more “What” questions (e.g. “What does transpose mean?”). Online participants asked more “Guess” questions (e.g. “Like this?”). Online environments are not a barrier to preschoolers' active word learning, but they could influence the types of requests for word meanings produced by preschoolers.

Online environments not a barrier to preschoolers questions about unknown words

“Why is the sky blue?” is one of the many questions commonly asked by preschool-aged children. Questions are a way for children to fill in the gaps of their knowledge about the world (Chouinard et al., 2007), but asking questions is not a simple feat. Children must first recognize that they do not know something, for instance, why the sky is blue (Rohwer et al., 2012). Then they must decipher who to direct their question towards (Clément et al., 2004; Koenig & Harris, 2005), and decide how to form an effective question that will result in the desired answer (Chouinard et al., 2007). Finally, they need to evaluate whether the answer they received is an adequate response to their question (Frazier et al., 2009). Despite this complexity, preschoolers are excellent at asking questions, and have even been estimated to ask between 69 to 107 questions per hour (Chouinard et al., 2007). There is an abundance of research on children’s question-asking (Callanan & Oaks, 1992; Chouinard et al., 2007; Frazier et al., 2016; Kemler Nelson et al., 2004; Ünlütak et al., 2019), but there remain gaps in the literature. Research on children’s questions about word meanings is limited, and previous research has largely focused on question-asking in live contexts (Janakiefski et al., 2022). The current study will address these gaps through an investigation of 5-year-olds' questions about unknown words in an online environment.

Information that is both potent and relevant to a child, and therefore the potential subject of their questions, is information about words (Janakiefski et al., 2022; Mani & Ackermann, 2018). In studying children’s questions about words, we operationalize the concept of active word learning. Active learning is a child recognizing that they do not know something, and the inclination to seek out the unknown information (Saylor & Ganea, 2018). Active word learning

is therefore a child recognizing that they do not know the meaning of a word and attempting to seek out the unknown word meaning (Jimenez et al., 2018). Much of the previous word learning research on preschool-aged children has focused on children's passive word learning, that is, how preschoolers learn words when they are provided with all of the necessary information (the label and the referent) (Janakiefski et al., 2022; Jimenez et al., 2018). There is limited research on how preschoolers actively seek information about words and drive their own word learning.

Preschoolers benefit from active learning processes. Active learning allows children to seek out information that interests them, therefore not restricting children to only the information they passively receive from others (Baldwin & Moses, 1996). Active learning also allows children to quickly find the answers to sought-after information, which can improve learning (Saylor & Ganea, 2018). Though research on preschoolers' active word learning is limited, there is a body of research on infants and toddlers that shows the early emergence of active word learning behaviors (e.g. Ackermann et al., 2020; Begus et al., 2014; Colonnese et al., 2010; Lucca & Wilbourn, 2018; Tamis-LeMonda et al., 2018). For example, 14-month-old infants use gestures to elicit linguistic input from their mothers (Lucca & Wilbourn, 2018; Tamis-LeMonda et al., 2013) and 18-month-old infants use pointing gestures to elicit labels for unknown objects. Importantly, infants are not gesturing merely to highlight interesting objects; they expect their pointing gestures to be responded to with label information. When infants are provided with no information or information about the function of an object, rather than an object label, they persist in their gesturing (Lucca & Wilbourn, 2019). Research on infant gesturing demonstrates preverbal children's ability to actively seek out information about words, but research on how older, verbal children seek out this information is limited.

Though an effective tool for eliciting object labels, gesturing would not be effective for eliciting information about abstract concepts that do not exist in a child's physical environment, such as word meanings. Verbal inquiries would prove more effective in eliciting information about unknown word meanings. Children's verbal skills rapidly increase as they enter the preschool years, granting preschoolers access to verbal information-seeking tools such as asking questions (Hoff, 2013). Exploring how preschoolers employ questions to uncover unknown word meanings is a step towards understanding how preschoolers make sense of abstract components in their environment. However, as the slew of research on active word learning is focused on infants and toddlers, we know little about how preschoolers employ verbal tools, such as asking questions, to gain information about words.

This is true even though there are many studies about preschoolers' question asking (Callanan & Oaks, 1992; Chouinard et al., 2007; Frazier et al., 2016; Kemler Nelson et al., 2004; Ünlütürk et al., 2019). Previous research on children's questions has focused on preschoolers "how" and "why" questions (Callanan & Oaks, 1992; Chouinard et al., 2007; Frazier et al., 2016; Kemler Nelson et al., 2004). Questions about words were excluded from analyses. The research that does exist on children's word-related question-asking is focused on children's requests for labels rather than the meaning of words (Chouinard et al., 2007; Ünlütürk et al., 2019). Exploring preschoolers' questions about word meanings provides valuable insight into how preschoolers drive their own word learning. Preschooler's questions demonstrate how preschoolers learn word meanings when their environment does not provide the necessary items for word learning (e.g. both the word and its meaning).

One study that has addressed the gap in the literature on children's questions about word meanings measured 3- and 5-year-olds' verbal information-seeking behaviors (e.g. questions or statements or uncertainty about word meanings) after exposure to unknown words (Janakiefski et al., 2022). Participants sat across from an experimenter and were asked to complete a series of actions using toy animals. Some of the action words were known (e.g. "Switch the cow and the bird") and some were unknown (e.g. "Transpose the cow and the bird"). The researchers recorded participants' questions (e.g. "What does transpose mean?") and statements of uncertainty (e.g. "I don't know what transpose means") following these words. Preschoolers produced more verbal information-seeking behaviors when exposed to unknown words ($M = 3.86$ of 9, $SD = 3.48$) than known words ($M = 0.22$, $SD = 0.49$). This finding was especially robust among the 5-year-olds (Unknown words: $M = 6.11$, $SD = 2.81$; Known words: $M = 0.11$, $SD = 0.32$). Also, when provided with uninformative definitions (e.g. "Transpose is when you transpose two things") following their questions about unknown word meanings, 5-year-olds were more likely to employ further verbal information-seeking behaviors ($M = 1.20$ out of 3, $SD = 1.40$) than when provided with informative definitions (e.g. "Transpose is when you switch two things") ($M = 0.10$, $SD = 0.32$). This study revealed preschoolers' use of questions as a verbal tool to obtain information about unknown word meanings.

The results of Janakiefski et al. (2022) point to preschoolers' active word learning through their use of questions to seek out information about unknown word meanings. However, it is unclear how robust the tendency is for preschoolers to engage in this type of active word learning. It is possible that preschoolers' word-related information-seeking behaviors are contingent upon a specific environment. For instance, Janakiefski et al. (2022) conducted their

study in-person. In-person environments have high social contingency and allow ample opportunities for joint attention between adult and child (Anderson & Pempek, 2005; Krcmar et al., 2007; Roseberry et al., 2009; Strouse, O’Doherty, & Troseth, 2013). This type of environment could encourage preschoolers to ask questions when they encounter unknown words. Environments with limited social contingency and limited opportunities for joint attention, such as online environments, may therefore inhibit preschoolers' active word learning (Anderson & Pempek 2005; Krcmar et al., 2007; Roseberry et al., 2009; Strouse, O’Doherty, & Troseth 2013).

Online environments present further challenges that could interfere with preschoolers' word-related question asking. Online environments pose higher attentional demands for preschoolers compared to in-person environments (Chiong, et al., 2012; de Jong & Bus, 2002). With an increased cognitive load preschoolers could fail to recognize that they were asked to perform an action with an unknown word, therefore missing the opportunity to ask a question about an unknown word. Also, during the preschool years children are critical of the reliability of an informant (Jaswal & Malone, 2007; Clément et al., 2004; Pasquini et al., 2007). Preschoolers use subtle cues, such as informant confidence (e.g. “This is a spoon” vs. “I think this is a spoon”) to decipher informant reliability. The increased attentional demands of online environments could make it difficult for preschoolers to simultaneously focus on the task and decipher informant reliability. As preschoolers prefer to direct their questions towards reliable informants (Corriveau & Harris, 2009), this could inhibit preschoolers from asking questions about unknown words in online environments.

There is a lack of research on preschoolers' active word learning in online environments, but research does exist on preschoolers' ability to learn words in online environments. Younger age groups have difficulty learning novel words in online environments compared to in-person environments (a gap known as the "video deficit") (Anderson & Pempek, 2005; Naigles et al., 2005; Troseth et al., 2018). Preschoolers, however, are more successful than their younger counterparts in learning words in online environments (Reiser et al., 1984; Rice & Woodsmall, 1988; Roseberry et al., 2009; Singer & Singer, 1998; Strouse et al., 2013). For example, whereas toddlers require support from a live experimenter to learn novel verbs from a video, 3-year-olds can learn verbs from a video alone (Roseberry et al., 2009). Also, popular children's shows such as *Sesame Street* have been found to improve 3- to 5-year-olds vocabulary development (Rice, 1990), and moderate media use has been linked to larger language gains for 5-year-olds (Dore et al., 2020). Preschoolers' ability to learn words in both in-person and online environments suggests that preschoolers may also engage in similar active word learning behaviors across both environments.

The goal of the current study is to investigate whether preschoolers engage in similar active word learning behaviors in online environments as they do in in-person environments. We adapted the procedure from Janakiefski et al. (2022) to be conducted via Zoom. On Zoom, we tested whether 5-year-olds were more likely to ask questions when presented with unknown words compared to known words. We then compared these results to those of Janakiefski et al. (2022) to see how preschoolers' online active word learning compared to preschoolers in-person active word learning. We used 5-year-olds, as they demonstrated more robust question-asking than 3-year-olds (Janakiefski et al., 2022). If preschoolers' active word learning is robust enough

to surpass the challenges of online environments, we should see a similar rate of question-asking about unknown word meanings across 5-year-olds in both in-person and online settings.

Alternatively, if 5-year-olds' rate of question-asking about unknown word meanings is greater in in-person environments, this could implicate online environments as a barrier to preschoolers' active word learning.

Method

Participants

The sample included 19 preschoolers ($n = 19$, $M_{age} = 5.5$ years, range 5.2–6.7 years, 10 female). We recruited participants using state birth records from the Southeastern United States. Participants were English-speaking, monolingual, hearing, and did not have language delays. One participant was excluded from analysis due to parental interference ($n = 1$).

Parents completed a demographic survey. Results clarified that the majority of participants (74%) were White, 16% of participants were Black or African American, 11% were more than one race, and one participant was Hispanic or Latino. Over half (53%) of parents reported a yearly household income of \$150,000 or more, 37% reported a household income between \$75,00 and \$150,000, and 10% reported a household income of \$75,000 or less.

We also collected data on participants' educational environment at the time of the experiment. Ten participants ($n = 10$) received in-person instruction and five participants ($n = 5$) received at least some online instruction. Four parents did not report on their child's current educational environments ($n = 4$).

The previous in-person study had a sample of 19 preschoolers ($n = 19$, $M_{age} = 5.4$ years, range 5.0–5.9, 12 female). Notably, the demographic breakdown of the current study was

different from that of the in-person study, in which 89% of participants were White and one participant was Indian. 26% of parents reported a yearly household income of \$150,000 or more, 47% reported a household income between \$75,000 and \$150,000, and 5% reported a household income of \$75,000 or less. Demographic information was not reported for 4 participants ($n = 4$) (Janakiefski et al., 2022).

Materials

We used Zoom to conduct the study. Parents were asked to collect 6 small toys that participants were familiar with and could move with one hand to use during the study. We created a PowerPoint as a visual aid to guide parents and participants through the different stages of the study. We shared the PowerPoint with participants using the “share screen” feature of Zoom. The PowerPoint contained 3 slides. The first slide introduced the university and the name of the research lab. Parents and participants saw this slide when they joined the Zoom call. The second slide was used for the short activity. The second slide contained images of six different animals (fish, pig, cat, elephant, penguin, dog). The last slide had an arbitrary burst shape in the middle. The purpose of this slide was so participants would not be distracted by slide two during the study. See the Appendix for images of the slides.

Materials included a set of 18 target action words: 9 known (hide, lift, wiggle, switch, turn, spin, touch, flip, and slide) and 9 unknown (transpose, invert, elevate, exchange, upend, rotate, mobilize, obscure, and jostle). Unknown words were selected based on their absence from the CHILDES transcripts by age 6, using the ChildFreq tool (Bååth, 2010). We also asked parents if each of the 18 target actions words were known or unknown to the participants. The

average number of words reported as known by the participants was 7.9 out of the 9 of the “known” words and 1.5 out of the 9 “unknown” words.

We created definitions for the 18 action words using known synonyms or phrases (e.g. “Exchange is when you trade one thing for another”). If possible, known words were used to create definitions for unknown words (e.g. “Transpose is when you switch two things”). Table 1 includes a list of all 18 action words and their definitions.

Target Word	Definition
Transpose	Transpose is when you switch two things.
Invert	Invert is when you flip something over.
Elevate	Elevate is when you lift something up.
Rotate	Rotate is when you turn something.
Exchange	Exchange is when you trade one thing for another.
Upend	Upend is when you put something upside down.
Mobilize	Mobilize is when you move something.
Obscure	Obscure is when you hide something.
Jostle	Jostle is when you wiggle something.
Hide	Hide is when you put something behind something else.
Lift	Lift is when you pick something up.
Switch	Switch is when you change the place of two things.
Turn	Turn is when you twist something.
Spin	Spin is when you turn something around.
Touch	Touch is when you tap something.
Flip	Flip is when you put something upside down.
Wiggle	Wiggle is when you shake something.
Slide	Slide is when you move something along.

Table 1. List of target action words and the corresponding definitions provided by the experimenter if a participant asked a question or stated uncertainty.

Design and Procedure

The study used a mixed design with word type (known vs. unknown) as the within-subjects factor and environment (online vs. in-person) as the between-subjects factor. All participants were exposed to the 9 known and 9 unknown action words in an intermixed list. We presented the words to participants in a fixed order with at most two known or unknown words occurring consecutively. The dependent variable was the number of trials that participants asked a question or stated uncertainty for known words and unknown words. Our procedure is a quasi-replication of the procedure used in Janakiefski et al. (2022).

Our study was conducted over Zoom. The participant and experimenter kept their microphones and cameras on during the experiment. We began recording the Zoom session before we presented children with the target words. Participants used 6 small toys during the experiment. We asked parents to have these toys on hand before joining the call. Parents were also asked to limit engagement with their child during the study, unless their child's attention needed to be redirected to the experimenter. Before beginning the study, participants engaged in a short activity. Participants saw a slide with 6 images of different animals (see Appendix). The experimenter presented a fact about one of the animals and asked the child to identify which animal the fact was referring to (e.g. "Can you tell me which animal can breathe underwater?"; "Can you tell me which animal has a big long trunk?"). The experimenter asked the participant 3

or 4 of these questions before moving on to the next activity. The purpose of this short activity was for participants to become accustomed to a prompt and response interaction with an experimenter over Zoom. Given that most of our participants (10 out of 19) had an in-person educational environment at the time of the study, an online prompt and response interaction may have been unfamiliar to them. After the short activity, we asked participants to show their toys. We told participants to show their first toy. If the label of the toy was not obvious to the experimenter (e.g. an animal name), then the child was asked what the name of the toy was. We proceeded in this fashion with each of the participants' six toys and we recorded the labels for all six toys. Experimenters then used these labels during the experiment.

We introduced the task and provided the following instructions: “I am going to tell you what to do with the toys. If you have any questions, if you don’t know what a word means, or if you don’t know what to do, just ask me. I have all the answers.” We asked participants to move their toys according to the target word given in the instruction (e.g. “Transpose the dog and the bird.”). After each instruction, participants were given between 4-10 seconds ($M = 6$ seconds) to complete an action or ask a question. If the participant did not complete an action or ask a question, the experimenter asked the child if they wanted to continue on to the next instruction. If the participant completed any action (regardless if it was the correct or incorrect action) the experimenter would acknowledge this with a phrase such as “Good job”, “Nice”, or “Alright” and continue on to the next instruction. If a child asked a question about the target word's meaning or stated uncertainty, the researcher gave the definition of the target word and allowed the child to attempt the action before continuing to the next instruction. See Table 1 for the

definitions of each target action word. See the Appendix for examples of participant questions and statements of uncertainty that elicited a definition from the experimenter.

If the child did not complete the correct actions or ask any questions after 9 trials, the experimenter reminded the child that they can ask any questions if they are unsure of what to do, as in Janakiefski et al. (2022).

Coding

The sessions were recorded over Zoom. Participants' verbal information-seeking behaviors were coded by the experimenter and a research assistant. One participant ($n = 1$) was not recorded. In each trial, coders gave participants a 1 if they asked an explicit question about the target word meaning (e.g. “What does transpose mean?”) or if they stated uncertainty (e.g. “I don’t know what transpose means”). Statements of uncertainty were less common than explicit questions. Out of the 124 total requests for information, only 26 were statements of uncertainty. Therefore, the two types of verbal information-seeking behaviors were collapsed in our main analysis. Coders gave participants a 0 if they did not ask an explicit question about the target word meaning or stated uncertainty. Participants received two scores between 0 and 9, one for known words and one for unknown words. A research assistant coded 25% of trials. Agreement between coders was 95.56% with strong interrater reliability ($Kappa = 0.91$).

Results

We ran a mixed model ANOVA with a within-subjects factor of word type (known vs. unknown) and a between-subjects factor of environment (online vs. in-person) to determine if 5-year-olds demonstrated the same pattern of information-seeking about word meanings online as they demonstrated in-person. We compared our online results to those of Janakiefski et al.

(2022), in which 5-year-olds demonstrated more information-seeking about unknown words ($M = 6.12$ out of 9, $SD = 2.81$) than known words ($M = 0.11$, $SD = 0.32$) in an in-person environment, $p < .001$.

There was a significant effect of word type (known vs. unknown), $F(1,36) = 137.931$, $p < .001$, $\eta^2 = .605$, but there was no effect of environment (online vs. in-person), $F(1,36) = 0.052$, $p = 0.820$, on information-seeking about words. Children asked an equal number of questions about known ($M = 0.68$, $SD = 1.16$) and unknown ($M = 5.63$, $SD = 3.43$) words in the online environment of the present study as in the in-person environment of Janakiefski et al. (2022). There was also no significant interaction between word type and environment, $F(1,36) = 0.895$, $p = .350$. 5-year-olds asked more questions about unknown words than known words in both online and in-person environments. See Figure 1 for the mean number of information-seeking trials by environment and word type.

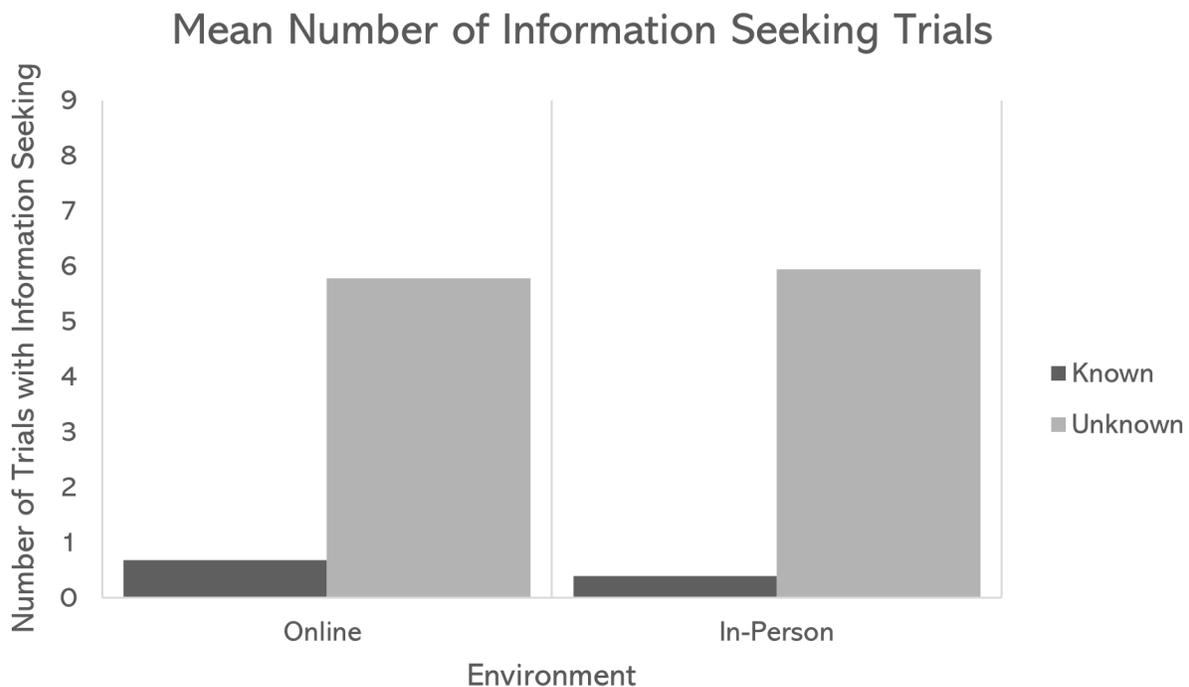


Figure 1. Mean number of information-seeking trials (trials in which children asked a question or stated uncertainty about a word meaning) for known and unknown words in both online and in-person environments. Each participant completed 9 known-word trials and 9 unknown-word trials.

We further explored whether the types of requests for word meanings that preschoolers produced differed across online and in-person environments. Participants' requests were transcribed and categorized into 4 different types: “What” questions (e.g. “What does transpose mean?”); “How” questions (e.g. “How do you do that?”); “Guess” questions (e.g. “Does transpose mean like this?”); and statements of uncertainty (e.g. “I don’t know how to do that.”). See Appendix for more examples of requests that fall into each question category. Table 2 shows the number of participant requests in each category. We ran a Chi-Square test of independence and found that environment does affect the types of requests that preschoolers produce about word meanings, $X^2(3, N = 19) = 8.95, p < .05$. We conducted three post-hoc pairwise comparisons using a Bonferroni adjusted p-value ($p = 0.017$) to see which types of requests were different across online and in-person environments. We used “What” questions as the reference group. See Table 3 for the three pairwise comparisons. The comparison between “What” and “Guess” questions was significant across environments ($p = 0.0069$). In-person participants asked more “What” questions about word meanings. Online participants asked more “Guess” questions about word meanings.

Environment	What Questions	How Questions	Guess Questions	Statements of Uncertainty	Total
Online	76	4	18	26	124
In-Person	91	7	6	20	124

Table 2. Number of participant requests for information in each category.

Pairwise Comparisons	P-Value
What vs. How	0.55
What vs. Guess	0.0069*
What vs. Statements of Uncertainty	0.19

Table 3. Chi-Square pairwise comparisons between different types of requests.

We explored additional factors that may have impacted participants' verbal information-seeking about unknown words. We analyzed whether previous experience with online educational environments impacted information-seeking about unknown words in our online sample. There were differences in the number of trials that participants requested information for unknown words between those receiving online instruction ($n = 5$, $M = 8.00$, $SD = 1.00$) and in-person instruction ($n = 10$, $M = 4.8$, $SD = 3.32$), ($F(1,13) = 6.683$, $p = .023$) at the time of study. These results have implications for how preschoolers' experience with online environments can influence their willingness to ask questions about unknown words in online environments.

Finally, we explored whether socioeconomic status impacted participants' questions about unknown words. Environment (online vs. in-person) was collapsed. We did not find differences in the number of information-seeking trials for unknown words between those living in a household with a reported yearly income of less than \$75,000 ($n = 3$, $M = 6.70$, $SD = 1.53$), \$75,000 to \$150,000 ($n = 16$, $M = 6.88$, $SD = 1.75$), or \$150,000 or more ($n = 15$, $M = 5.53$, $SD = 3.87$), $F(2,31) = 0.301$, $p = .742$.

Discussion

The current study was an investigation into the active word learning behaviors of preschoolers in online environments. Specifically, we explored whether the tendency of 5-year-olds to request information about unknown word meanings (Janakiefski et al., 2022) persists in online environments. We found no differences in 5-year-olds' pattern of information-seeking about known and unknown word meanings across in-person and online environments. Children sought information about new words an equal amount across both environments. This indicates that 5-year-olds' active word learning is robust and not limited to in-person environments, despite the lower social contingency and increased attentional demands of online environments (Chiong, et al., 2012; de Jong & Bus, 2002; Roseberry et al., 2009; Strouse et al., 2013). This study provides insight into neglected areas of study, such as how children employ active word learning beyond infancy, how children request information about words beyond object labels, such as word meanings, and how online environments impact active word learning processes.

We did find differences in the types of requests for unknown word meanings that preschoolers produced in online versus in-person environments. In-person participants asked

more “What” questions (e.g. “What does transpose mean?”) to gain information about unknown word meanings, whereas online participants asked more “Guess” questions (e.g. “Does transpose mean like this?”). These differences could be due to specific characteristics that distinguish online and in-person environments, though future research is needed to uncover these characteristics.

The differences in the types of requests produced by online versus in-person participants could also be caused by differences in the socioeconomic makeup of the online and in-person samples. The online sample had slightly less socioeconomic diversity, with 53% of participants in the highest income category (a yearly household income of \$150,000 or more) compared to only 26% in the in-person sample (Janakiefski et al., 2022). A handful of previous studies found that SES impacted the types of questions that preschoolers produced (Solis & Callanan, 2016; Ünlütürk et al., 2019). There are also differences in caregiver responses to preschooler’s questions across SES that could impact preschooler’s questions (Kurkul & Corriveau, 2018). The target of preschoolers' questions in these previous studies was not unknown word meanings. However, the differences in socioeconomic status between our online and in-person samples could explain the differences in participants' production of “What” and “Guess” questions across the two samples.

To explore whether SES played a role in the types of requests for word meanings that participants produced, we examined the reported household income of participants that asked “Guess” questions. Overall, “Guess” questions were rare, accounting for only 24 out of 248 total requests for information; this is especially true compared to “What” questions which accounted for 167/248 total requests. Only 8 out of 38 online and in-person participants asked “Guess”

questions. There was at least one participant from each of our income categories (less than 75,000, 75,000-150,000 and 150,000 or more). However, the sample size was too small to detect differences across SES categories. Given the current sample, we were unable to reach a conclusion about the effect of SES on preschoolers' production of "Guess" questions. Future research must be conducted to uncover the role of SES in shaping the types of requests for word meanings produced by preschoolers.

The results of our main analysis found that preschoolers' information-seeking about unknown words is the same across online and in-person environments. One potential explanation for why we found no differences in preschoolers' information-seeking about unknown words across environments is that 5-year-olds have had ample experience with online environments. In 2020, 97% of homes with children between 0 and 8 had at least one smartphone, 75% had a tablet, and 48% of children owned their own mobile device. 5 to 8-year-olds in 2020 had an average screen time of 3 hours and 5 minutes a day (The Common Sense Census, 2020). Also, the recent onset of the COVID-19 pandemic has exponentially increased children's digital media usage—with children in 2020 spending 25% more time watching online videos, 76% more time on social media, 23% more time on video games, 54% more on educational technology, and 49% more on communication technology (e.g. Zoom) than children before the pandemic—and has caused children to switch to online learning environments (Qustudio, 2021). Experience with online environments could increase preschoolers' readiness to ask questions when exposed to unknown words in these environments.

Our results aligned with the idea that participants' experience with online environments supported their willingness to ask questions about unknown words. We found that among online

participants, those that received at least some online instructions at the time of the study asked more questions about unknown words than participants who received in-person instruction at the time of the study. Preschoolers' familiarity with online environments could explain the in-person-like question-asking that we saw in our online sample. Although, a large portion of preschoolers' interactions with online environments occur outside of the classroom (Qustudio, 2021), which our analysis did not account for. Future research with more thorough data on participants' total screen use, could shed more light on this relationship between preschoolers' experience with online environments and their propensity to ask word-related questions in online environments.

Another potential explanation for the similarities in word-related question-asking across different environments is the potency of social contingency. Socially contingency involves a back-and-forth interaction in which one social partner responds to another social partner in a timely, appropriate manner and vice versa. Online environments are less socially contingent than in-person environments (Anderson & Pempek 2005; Krcmar et al., 2007; Roseberry et al., 2009; Strouse et al., 2013), but mediums such as Zoom and Facetime allow for online social contingency. Previous word learning research has found that preschoolers are particularly successful in word learning if their online environment is socially contingent. For instance, 3-year-olds that watch an educational television program with a dialogic, on screen actress scored higher in expressive vocabulary compared to those who merely watched the program (Strouse et al., 2013). Social contingency is crucial for question-and-response interactions and may have played a key role in our participants' willingness to ask questions about words. It is possible that a socially contingent interaction is sufficient in motivating preschoolers to ask

questions about word meanings, regardless if the interaction is in-person or online. Or perhaps given a socially contingent partner, preschoolers no longer distinguish online and in-person interactions in their potential for information gain about word meanings, thus explaining the similar pattern of questions about known and unknown words across online and in-person environments.

The presence of a socially contingent partner could explain the similarities in question-asking about unknown word meanings across environments. However, previous research has shown that older preschoolers no longer require social contingency to learn words in online environments (Gaudreau et al., 2020), which could point to a decreased need for social contingency to motivate word-related questions in online environments. For example, 4-year-olds demonstrated similar vocabulary gains from book reading over video-chat, book reading through pseudo-contingent video, and live book reading (Gaudreau et al., 2020). Whereas the extent of 3-year-olds' vocabulary gains depended on the level of social contingency (Strouse et al., 2013). As children get older, they may no longer require social contingency as a prerequisite to their questions about unknown word meanings.

A third potential explanation for the lack of differences in information-seeking across modality could be that by age 5 children have had ample practice with asking questions, and their question-asking is therefore robust enough to pervade across different environments. With counts upwards of 69 questions per hour during the preschool period, it is clear that children will have asked many questions by the time they reach their fifth birthday (Chouinard et al., 2007). And, as demonstrated in both Janakiefski et al. (2022) and the current study, a sizable number of these questions are likely about word meanings. 5-year-olds' question-asking about word

meanings was robust in online environments. Perhaps 5-year-olds have mastered the skill of asking questions about unknown words, and can produce these questions across a myriad of different environments. Further, Jankiefski et al. (2022) revealed developmental differences, finding that 5-year-olds asked more questions about unknown word meanings than 3-year-olds (2022). This further supports the notion that as preschoolers reach their fifth birthday, they have become experts in asking questions about word meanings and will engage in this type of active word learning robustly— whether that is through a screen, in interactions with low social contingency, or in unfamiliar environments.

A limitation of the current study is the homogeneity of our sample. Most parents (81%) reported a household income of \$75,000 or higher, with over half (39%) reporting a household income of \$150,000 or higher. Children from lower socioeconomic backgrounds have been found to ask fewer questions than those from middle or upper socioeconomic backgrounds (Gauvain et al., 2013; Ünlütürk et al., 2019). In our analysis, we did not find differences in question-asking across SES. However, our total sample size was small ($n = 38$), making it difficult to detect SES differences. Also, preschoolers from low SES backgrounds were underrepresented in our sample, therefore skewing our results. SES can also impact preschoolers' access to technology. Lower SES households have less access to the internet and technology than upper SES households, though this gap is narrowing (National Center for Education Statistics, 2020; Pew Research Center, 2021). Decreased access to online environments could reduce preschoolers familiarity with such environments, making preschoolers from lower SES less likely to engage in online active word learning behaviors.

We also sampled preschoolers embedded in a Western culture. Word-related question-asking can look different across different cultures, due to factors such as caregiver responsiveness and children's independence (Gauvain et al., 2013). Active word learning could also manifest in ways other than asking questions across different cultures. It is important to avoid deficit assumptions when exploring question-asking across different backgrounds, and instead consider how different backgrounds influence preschoolers' active word learning (Callanan et al., 2020).

The current study documented preschoolers' use of questions in online environments to seek information about unknown words. Next steps for future research could be to explore the potential learning benefits of active word learning, in both online and in-person environments. In a recent pilot study in my lab researchers investigated whether asking questions about unknown words aids preschoolers' in their short-term retention of unknown word meanings (Janakiefski et al., 2022). The study was conducted over Zoom. Curiously, the researchers found that asking questions did not improve preschoolers' short term retention of unknown word meanings. This may suggest that though online environments are not a barrier to preschoolers' active word learning behaviors, they may be a barrier to the potential learning benefits of active word learning. However, there is not sufficient evidence to draw such conclusions. Researchers noted other factors that may have inhibited preschoolers' retention, such as the difficulty of the learning task. Future research comparing preschoolers' short-term retention of word meanings in online versus in-person environments is needed to uncover how online environments impact the learning benefits of active word learning.

The current study illustrates how preschoolers drive their own word learning, supplementing the breadth of research on preschoolers passive word learning. It also sheds light on the scope of preschoolers' active word learning. Preschoolers persist in their question-asking about words across online and in-person environments. This rules out online environments as a barrier to preschoolers' active word learning. Given the rapid proliferation of technology and the sudden shift to e-learning following the COVID-19 pandemic, it is crucial for parents, educators, and researchers alike to understand how online environments impact young children's word learning behaviors.

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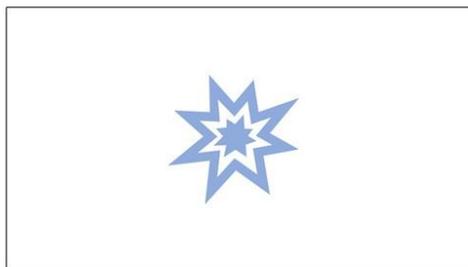
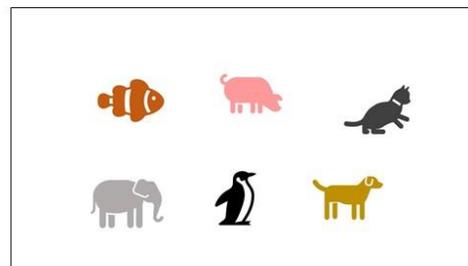
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Appendix

PowerPoint



Examples of information-seeking that elicited a definition from the experimenter

Types of information-seeking	Examples
‘What’ Questions	“What does invert mean?” “What does exchange?” “What does slide mean again?” “Obscure. What does obscure mean?” “What’s invert mean?” “What’s upend?” “What is rotate?”

	"Obscure? What does that mean?"
	"What's that mean?"
	"What does that mean?"
'How' Questions	"How do you do that?"
	"How are you supposed to do that?"
	"How do I do that?"
Guess Questions	"Is this transpose?"
	"Does switch mean like this?"
	"Like this?"
	"You mean like that?"
	"Like this frog is trading for a new cow?"
	"Like this or like sideways?"
	"Like this when hes like sliding on something like?"
	"Like in their place?"
	"Do that?"
Statements of Uncertainty	"I don't know what mobilize means"
	"I don't know what it means"
	"I don't even know what transpose means"
	"I don't know what that means"
	"Slide?"
	"I still do not know what that means"