

# **Qualitative input vs. Quantitative input:**

Mothers as Educators in Problem Solving Situations with their Toddlers

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**Qualitative input vs. Quantitative input:** Mothers as Educators in Problem Solving Situations with their Toddlers

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## Abstract

Communication and social interactions contribute to child development. Interactions between mothers and their children are complex and are in many ways built upon communication and trust. Mothers provide different forms of input in their interactions and communication with their children. This input can be of a qualitative kind, where the information conveyed involves a special meaning or form of deliverance. However, the input can also be quantified. Quantitative input concerns the amount of input provided, and the linguistic characteristics given to that input. Although a lot of research has examined how either the quality and quantity of linguistic input relate to children's language development. Few studies have compared the role of these two different kinds of input in specific learning situations and how they concurrently and longitudinally relate to child task success in cognitive task situations in particular. The current study attempts to look at how the quality of mothers' input (i. e., mothers' sensitivity and cognitive stimulation) and the quantity of mothers' input (i.e., mothers' number of utterances and questions) are related to task success at 24 months and 36 months of age. The study found that maternal sensitivity is related to the children's task success, while maternal utterances and questions were related to children's failed task attempts. This suggests that the type of information a child receives during a task situation is relevant to how well the child performs on said task. However, further studies into the field is highly encouraged.

*Key words:* Mother-child interactions, scaffolding, task situations, sensitivity, cognitive stimulation, child-directed speech, task success

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## QUALITATIVE INPUT VS QUANTITATIVE INPUT

The language we use is constantly adjusted and attuned to the people we talk to, and the situations in which we are communicating (Tomasello, 2003). Parents are especially, and from the beginning of their child's life, likely to alter their language and tone of voice to their child's developmental level (Baumwell, Tamis-LeMonda, & Bornstein, 1997), to align their communicative acts to their child's cognitive development in a way that challenges them (Damast, Tamis-LeMonda, & Bornstein, 1996) and are overall sensitive to what their children are attentive to (Wu & Gros-Louis, 2014). Language is a large part of the communication we use every day. Communication stems from the Latin word "communicare" which means "to share" (Tetzchner et al., 1993). Parents use language in order to share knowledge, information, beliefs, thoughts, ideas, and values with their children, and the way parents share these aspects of life varies across developmental levels, situations and societies.

The communication parents share can be viewed in terms of quality and quantity. The quality and quantity of input parent provide their children has particularly been studied in association with language development. As mentioned is language important for communicative purposes. It is therefore important to understand how children learn language as it can work as a "stepping stone" in further developing their knowledge and skills. Languages provides us with the opportunity to question the ideas that are presented to us, and it gives us the opportunity to express what we desire.

Researchers disagree to the extent of which the quality or quantity of input children are exposed to shapes their language and cognitive development. Some researchers have emphasized the importance of the quantity (e.g., number of words and utterances of a certain type) of parental language input (Hart and Risley, 1995), while others have highlighted the importance of the quality (e.g., cognitive stimulation and sensitivity) of the input parents provide their children (Damast et al., 1996).

The quantity of input pertains to the amount of words, utterances and questions mothers produce during a mother-child interaction (Hart & Risley, 1995). Exposure to language has been found to be a predominant asset in language learning (Hart & Risley, 1995). This indicates that children are able to learn language only by hearing their parents speak to them.

The quality of input looks into the interaction between mother and child. Sensitivity and responsiveness is of a qualitative nature as it encompasses how mothers respond to their children, understand their children's needs, and the predictability of the responses mothers provide (Ainsworth, Bell & Stayton, 1972). Cognitive stimulation, pertains to how the mother stimulates the child and promotes learning in the interactions she has with her child (Owens et

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al., 2010). The quality of input in many ways pertains to how child-centered a mother-child interaction is (Owens et al., 2010). Sensitivity and cognitive stimulation has been associated with language development, but also cognitive development (Tamis-Lemonda, Kuchirko & Song, 2014).

Both point of views is equally interesting when it comes to how children learn and succeed in problem solving situations with their mothers. Not many studies have studied the types of input, and which one is the most related to child success in a task situation. It is important to understand how children learn, and what types of input that profit learning achievement. Learning situations are everywhere for young children and toddlers, and it is therefore interesting to see how we best can aid their learning, and influence their future learning by mapping out what children need from us, the adults around them, in order to achieve their goals and sense of accomplishment.

Parents use “scaffolding” when they teach their children something novel or something that is outside of the child’s actual development (Wood, Bruner & Ross, 1976). Scaffolding is a temporary aid that more knowledgeable others provide as a tool to support learning that is beyond what the child (learner) already knows. The scaffolding parents use in a task situation is therefore built upon parental knowledge of how much the child already knows or has the skills to do alone, and what the child needs in order to succeed in a task (Mulvaney et al., 2006; Vygotsky, 1978).

Interactions with adults can have a supportive function for children’s social and cognitive development more generally (Rogoff, 1998; Vygotsky, 1986). The interaction that occurs between mothers and their children in a problem solving situation is noteworthy as there are so many dimensions involved in the interaction (we will get into many of them later on in this paper). Although these interactions, when studied, are not truly naturalistic to the everyday interactions that occur in their respective homes; these interactions can still produce helpful insights into the dynamic and mechanisms behind these dyadic-interactions.

Most interactions between mothers and their children are affected by the activities and appointments of everyday life. It is therefore important to see what children can achieve without the parent being distracted. This so to figure out what the most valuable type of input is in a problem solving situation within the mother-child dyad, so that it best benefits the child. The form of input that also is the most conducive to child task success, in order to provide children with a sense of accomplishment.

Understanding how we best can teach our children is essential because there are so many technological distractions in today’s society. Today there are apps for everything and

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analog communication is almost eradicated. In the USA 95% of the population owns a cellphone, and 77% owns a smartphone in 2017 (Kildare & Middlemiss, 2017). In 2015, 85% of the Norwegian population had a smartphone, and 96% had internet access at home (Statistics Norway). The amount of time people spend on these devices has increased rapidly since they first emerged, and most of us use these devices on a daily basis (Statistics Norway). Studies have found that mothers who are absorbed in their devices are less accessible to their children than when they are not distracted by their devices, and provide children with less verbal and nonverbal input than when not distracted (Radesky et al, 2014). It is therefore important to investigate how our children learn and what aspects of a learning situation that is most conducive to task success and will benefit the child the most. Understanding the mechanisms behind children's learning will allow us to encourage nourishing interactions and provide information to parents, day care centers, and schools to make sure our children receive the best support in their future learning situations as possible.

### **The quality of input: Mothers' sensitivity and cognitive stimulation**

Although parents are not formally trained as pedagogues, they are important contributors to children's development and learning (Holt, 1989). Children are constantly learning from the situations they encounter and the people they encounter them with. Most situations in everyday-life are learning situations for children.

### ***Maternal responsiveness and sensitivity***

Sensitive mothers respond appropriately and consistently to their children's facial expressions, movements, gestures, vocalizations and cries (Ainsworth et al., 1972). Sensitive and responsive parenting ensures that children feel safe and understood when communicating with their caregivers. Parents who are sensitive have an underlying understanding of what their child needs at any given time, and thus, respond with the concurrent action or behavior in order to satisfy and stimulate their children (Baumwell et al., 1997).

Appropriate amount of response is essential to sensitive mothering. The mothers who respond frequently to their children and who are always close to their children are not necessarily the mothers who are found to be sensitive (Ainsworth et al., 1972; Baumwell et al., 1997). The response has to match the communication of the child, and response pattern from the mothers should be relatively consistent in order to be viewed as sensitive (Ainsworth et al., 1972). Sensitive parents understand their children's need and can differentiate specific needs from other needs. They also see the importance of adequate input and information.

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Mothers who contingently speak in response to their children's glances towards them were found to be less sensitive than mothers who encouraged their children's attention to objects contingent on the children looking at them (Bornstein & Manian, 2013). Explicitly, merely vocally responding to the child, or responding in the wrong amount of time, length or fashion desired by the child is not enough: the response has to be representative and appropriate to the child's needs at the time.

The responsiveness parents provide predict their children's language development and cognitive development (Tamis-LeMonda et al., 2014). Before children can verbally express themselves they are exposed to the (semantic and pragmatic) meaning of language. Around the end of their first year of life, children understand that language is an intentional action intended to communicate with others (Wood et al., 1976). Thus, as children grow older they understand that they can capitalize on their mothers' and other adults' knowledge in order to create meaning and understand the social world around them (Tomasello, 1995). Sensitive responses to children's gestures and communicative attempts have been associated with improvement in language comprehension for children (Wu & Gros-Louis, 2014). The mother-child interaction is bidirectional, and therefore can gestures from children aid parents in understanding what the child is interested in, and therefore sensitively respond to the child's behavior. The bidirectional nature of a sensitive mother-child interaction is important as the child's interests are of focus. Redirecting a child's attention to other stimuli, objects, or activities other than the ones they actually are interested, has been found to hinder language acquisition (Wu & Gros-Louis, 2014).

Language development is connected to attachment and sensitivity in the sense that mothers who have healthy attachments to their children, usually also are high in sensitivity, and thus appear to have more interactions with their children overall (Onnis, 2017). This in return means that the children of these mothers are more exposed to language and are more frequently interacting face to face with their mothers. More exposure to language has also been associated with larger vocabularies and higher IQ scores for children 3 years and older (Hart and Risley, 1995).

Furthermore, research has found that sensitive and responsive parenting is highly associated with cognitive development (NICHD, 2000; Tamis-LeMonda et al., 2014). Sensitive mother-child interactions have been found to be more supportive and verbally stimulating than less sensitive mother-child dyads (NICHD, 2000). The children in these sensitive dyads have been found to perform better on cognitive tests, as well as they have been linked to better language comprehension and vocabulary production at 24 and 36 months

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of age. This is important as sensitivity and responsiveness is found to have a significant relation to cognitive development (Tamis-Lemonda et al., 2014), which again could be applicable to problem solving situations and learning situations.

### *Maternal cognitive stimulation*

Cognitive stimulation is another form of qualitative input that stimulates the development of children's mental and physical abilities, such as their language and thought (Caughy & Owen, 2015). Cognitive stimulation is the actions and behaviors mothers exercise to improve and promote further learning (Vygotsky, 1978). An example of this could be to continue to talk about everyday objects in a fashion that expands beyond what the child already knows: not merely naming the object and informing the child of its use, but also for instance informing the child of the object's color, texture, or shape. Thus, cognitive stimulation is first and foremost a qualitative aspect of input children receives, as it looks into what is being informed and how, and not merely how much input a mother is providing (quantitative input). Studies have indicated that the quality of language input is a better predictor of language outcomes than the quantity of input (Cartmill et al., 2012; Hirsh-Pasek et al., 2015). Children have been found to learn novel words and their meaning by only hearing the words in context a few times or just once, which means that the variety of vocabulary introduced to children is a better predictor than the amount of times children are introduced to novel words (Cartmill et al., 2012). Children tend to learn novel words more promptly in a social interaction, for example with their parents, than outside a social interaction (Adamson, Bakeman & Brandon, 2015). Therefore, the setting in which children are being taught could influence the learning outcome children achieve. The interaction between child and mother could therefore be more important to the learning process than merely giving a child instructions and telling them what to do. The specific words that are spoken in a learning situation might therefore determine the outcome of the learning situation.

Moreover, there have been found different associations between cognitive stimulation and children's language abilities for different age groups. Bradley et al. (2001) found that cognitive stimulation has a more profound effect on language development and ability for younger children (3-4 years of age) compared to older children (10-11 years of age). High quality of childcare has also been found to be a predictor when it comes to cognitive- and language development (Jaeger, 1999).

Given that prior research has shown maternal sensitivity to be associated with child language development (Cartmill et al., 2012; Hirsh-Pasek et al., 2015; Tamis-LeMonda,

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Bornstein, & Baumwell, 2001; Tamis-LeMonda, et al., 2014), social and cognitive skills (Bradley et al., 2001), and given that another line of research suggests that overall cognitive stimulation in learning situations is related to cognitive abilities (NICHD Early Child Care Research, 2000) and language development (Bradley et al., 2001). One question that still needs to be answered is how this is related to task success (i.e. solving a puzzle) at different ages, and also how high-quality input compares to other forms of maternal input (i. e. quantitative) in concrete learning situations.

### **The quantity of input: The number of mothers' language input and instructions**

#### *The concept of child directed speech*

Modifications of speech for children is a universal phenomenon (Fernald et al., 1989; Saint-Georges et al., 2013). Child-directed speech (CDS) is characterized as shortened, simplified utterances that are more high-pitched in their tone, than the adults would otherwise utilize in their conversations with other more adult communication partners (Foursha-Stevenson et al., 2017). When speaking to children, adults talk more about specific events or objects, particularly in the present-tense. This form of communication is found in most communication between adults and children, and this interaction requires joint attention between the child and the adult directed towards an action or an object. These social interactions with others are vital to child development, in parts, as children learn language through social, communicative interactions (Vygotsky, 1986).

Most of the characteristics of Infant Directed Speech (IDS) or Child Directed Speech (CDS), have been found in numerous and varying cultural languages including American English, British English, Italian, German, Japanese and Mandarin (Fernald et al., 1989; Saint-Georges et al., 2013). Evidence also suggests that modifications and alterations also occur in sign language (Masataka, 1996). When mothers in one study signed with their deaf infants, they signed slower and used more repetitions as well as exaggerated movements compared to when they signed with other adults (Masataka, 1996). Furthermore, mothers of children with both down syndrome and autism spectrum disorders adjust their speech to their child's developmental abilities and language skills, not only in accordance with chronological age (compared to typically developed peers) (Fidler, 2003; Venuti et al., 2012; Saint-Georges et al., 2013).

However, mothers with postpartum depression are found to use fewer of the prosodic (emphasis and intonation patterns of an utterance) modifications of CDS than mothers without

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postpartum depression. In fact, infants of mothers with postpartum depression show less learning from the CDS of a non-depressed female speaker than infants of non-depressed mothers (Kaplan et al., 2012). This difference in children's in ability to learn continues even after the infants' mothers are no longer clinically depressed, suggesting exposure to early features of CDS may support the infant's attention and responsiveness to others in relatively long-lasting ways (Kaplan et al., 2012).

A study done by Fernald and colleagues (1989) demonstrated that mothers and fathers in different countries and cultures have a comparable approach to the ways in which they talk to their children. The study looked at five groups (mother, father and child) from each of the six different language backgrounds (German, Italian, French, Japanese, British English and American English) when the children were between 10 and 14 months of age. The main purpose was to distinguish between specific features that would differentiate the ways in which adults speak to verbal children from the ways in which they communicate with a preverbal toddler. The study found that there is a consistency in the prosodic modification patterns used in Infant-Directed Speech. Across languages both mothers and fathers were found to have shorter utterances and longer pauses when they spoke to the infant than when they spoke to an adult. In addition, both mothers and fathers elevated the pitch of their baseline utterances and had a higher peak frequency in their infant-directed speech than in their adult-directed speech (ADS); both of which are very common features of child-directed speech as previously defined. Fernald et al. (1989) propose that these findings demonstrate the developmental function of caretaker's intonation across languages to "regulate infant arousal and attention, to communicate affect, and to facilitate speech perception and language comprehension" (p. 478).

CDS has been found to be essential in terms of language development for young children, especially for toddlers (Foursha-Stevenson et al., 2017). In particular, are children more perceptive to learning new words when they are taught in child directed speech rather than with adult ADS. CDS also enhances attention, which is important for children to be able to listen and learn what they are taught. The properties of CDS retains children's attention as they are more "inviting" and "entertaining" than ADS, furthermore, CDS involves a lot of repetition and shorter utterances, which children seem to prefer. Children have been found to have greater brain activity in response to infant-directed speech than to adult-directed speech (Naoi et al., 2012). The difference in activation brain patterns were even significant when the infants were introduced to unfamiliar female speakers in IDS, with an even greater increase in activation when they heard their mothers speak in IDS.

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Children over the age of five seem to be indifferent when learning novel words, to whether or not the words were presented in CDS or ADS (Foursha-Stevenson et al., 2017). This indicates that CDS is a helpful tool in language acquisition up until about the age of 5. This is also because five and six year olds master complex sentences and learn new words generally more rapidly than children who are just beginning to master complex sentences around the age of three or four. Five and six year olds are more experienced than younger children and therefore rely less on the helping characteristics of CDS, however, the effect of CDS also depend on the child's developmental stage and the difficulty of the task.

Even four year olds adjust their speech when they are speaking to younger children (Shatz & Gelman, 1973 in Foursha-Stevenson et al., 2017). Even young children know when they are speaking to someone with inferior skills, and thus even they scaffold their language input so that the younger conversationalist understands what they are conveying.

In many ways Child Directed Speech is a way for parents to support their children further both in familiar situations, but also especially in new situations, in which children may not understand all the elements exclusively on their own (Sonnenschein, Baker & Cerro, 1992). The way parents speak to their children is important as the qualities of CDS is vital to their attention and ability to understand what their mothers are saying to them in a task situation. The communication between mother and child may therefore be affected by the way mothers scaffold their language as well as their behaviors in a problem solving situation.

Although child-directed input literature has been focused on the linguistic simplicity and adjustment that parents make, there has also been a strong focus on the importance of children receiving enough input. In their seminal study, Hart and Risley (1995) showed how the amount of utterances and words that children are exposed to are highly correlated with children's language development and cognitive development. However, Rowe (2012) state that parents in large parts scaffold the ways in which their children's vocabulary acquisition. The types of words and narratives children are exposed to, determine the differences in children's language abilities. Although these findings slightly differ, they underline the importance of exposure to language when it comes to child development.

### ***Maternal questioning and verbal instructions***

Research has also found that the ability for children to ask questions and the ability for children to answer questions is relevant to cognitive development (Chouinard, Harris & Maratsos, 2007). This especially pertains to parental questions as questions often challenge the child more than statements and other forms of verbal instructions. In particular, has "Wh-



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questions” such as “what, why, where” been associated to furthering cognitive development and language abilities. These types of questions require more from the child verbally and cognitively compared to yes/no questions (Rowe, Leech & Cabrera, 2016). Fathers have been found to ask more “Wh- questions” than mothers (Rowe, Coker, & Pan, 2007; Rowe et al., 2016).

In addition to question-asking, children benefit from verbal instructions and talk from parents when it comes to language development as well as cognitive development (Hart & Risley, 1995). There has been found a strong link between verbal input from parents and academic success, language abilities, and IQ (Hart & Risley, 1995). The study found that parents who spoke more to their children between 7 and 36 months had children who performed better in academic settings at age 9 than children whose parents did not speak as much to their children. Therefore, exposure to language has been found to be highly significant in child development, and in particular to later cognitive achievements (ref!).

Furthermore, parents are able to scaffold their children’s vocabulary attainment by exposing them to different types of narratives and talk during different times in development (Rowe, 2012). It is important that parents speak in a manner that the child understands, yet still challenges the children to a certain point so that they are able to pick up and learn novel words. The more speech children are exposed to, the more they are able to renew and expand their own vocabularies. The number of words children hear is connected to the number of words they know which again is related to their caregivers’ vocabularies.

In sum, given that research suggests that not only is the quality of maternal input (i.e., maternal overall stimulation style) important for child development (Baumwell et al., 1997; Damast et al., 1996), but the quantity of maternal input and questions is also vital to children’s language, academic achievement and learning (Chouinard et al., 2007; Hart & Risley, 1995; Rowe, 2012; Rowe et al., 2016; Vygotsky, 1978; Wood et al., 1976). One question that remains to be answered is the degree to which one kind of input is more important than the other in specific learning situations. However, very little previous research has concurrently compared how such qualitative and quantitative inputs relate to child learning outcomes across different time points in toddlerhood.

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### **Children's language and learning patterns in toddlerhood**

Children's language development is influenced by individual differences, and typically children develop at different paces, yet there are some characteristics that are general to typical child development.

### ***Typical language milestones and development in Childhood***

The human language continues to develop throughout life, however, the first five years of life are the most critical for language development (Cartmill et al., 2013). Language skills are not given to us at birth in the sense that we automatically know how to speak a language or how to successfully communicate with others without any misunderstandings. However, there are ways in which we learn how to communicate. Language development is a continuous process as well as it is discontinuous (Tetzchner et al., 1993). There is a continuous process to expanding our vocabularies. It is a quantitative aspect to language development. However, learning to string words together and then learning to create sentences is a discontinuous aspect in language development and language acquisition. It is one of the qualitative aspects to language development.

Before infants and individuals are able to express themselves verbally and initiate interactions and communications with adults and others around them; adults use signals that children express as clues to interpret the infant's interests, preferences, and well-being (Goldstein & West, 1999). The most important, and perhaps most primitive, signals from an infant is crying, vocalizations, and smiling. These are the typical signals that adults respond to, and are therefore an efficient way to express a need for communication from a developing baby.

The first sounds that children make that do not resemble crying, are called cooing (Tetzchner et al., 1993; Tomasello, 2003). Children begin to coo when they are about 2-3 months old. These sounds resemble babbling, however, they are more indistinct in sound. Adults usually experience cooing-sounds as positive and pleasant sounds, interpreting them as signs of happiness. In addition, the infant's activity that is involved when the cooing occurs determines how the parents interpret their baby's coos. Fast breathing, panting and spitting sounds are associated with the baby being excited. These signals are important in development as they help adults to see their babies as social creatures and thus involve them into further social interactions (Vygotsky, 1978; Onnis, 2017). Social interactions are important as they expose children to the world around them, and specifically the language that is spoken in the given society.

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Eye movements and gestures are the most important preverbal communication behaviors (Tetzchner et al., 1993). They act as clues and tools for adults to create shared attention with their child. This can be something as simple as that a child is looking at a toy, an adult pick it up, shows it to the child, and talks about the object at hand. Studies have found that adults name and label the things children are looking at 50-70 percent of the time, which is imperative for further development and for vocabulary increase (Woodward & Markmann, 1998 in Tomasello, 2003). Pointing is another aspect of preverbal communication and gestures. It is an important tool used both by children and adults during interactions.

Research has found that children as young as 12 months of age, before they have acquired language, point informatively, specifically in order to appropriately communicate with knowledgeable and ignorant adults (Liszkowski, Carpenter, & Tomasello, 2008). Children were also found to point with the “prosocial motive to help others without direct benefit for the self” (p. 738, Liszkowski et al., 2008). Furthermore, the complex cognitive processes that previously only were attributed to older, more verbally communicative children have also been found in pre-linguistic children. They understand that pointing is an intentional act in the active behavior and notion that communication is. Pointing is commonly accepted as the gesture that allows shared reference in communication with others both before and after language is developed (Rodriguez et al., 2015). Pointing is a direct and specific way to refer to objects in order to attain joint attention. Children usually start to point between the ages of 6 and 8 months. In learning situations pointing is seen as an explicitly vital tool used when instructing children to for example learn new things or put together a puzzle. Pointing is important because it is a mutual gesture that both parties are able to do and understand the intent of.

Children begin to babble around their half birthday (Tetzchner et al., 1993). This babbling moves into imitating the words adults use, before children actually speak a language and pronounce “actual words”. Children learn to say their first words around the age of 8-17 months (Tetzchner et al., 1993; Tomasello, 2003). Around the age of six most children have the basic foundation and the effective language that is required to communicate mostly without misunderstandings. Although language development continues, the most fundamental and essential parts of language acquisition are usually set by the age of six. Vocabulary tends to develop throughout life.

Social interaction is imperative to the development and the production of speech, as well as babbling in infants (Gordon & Watson, 2015). Social interactions promote a response to infant babbling such as smiling, speech, and touching. This again, reinforces the infant to

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continue to produce vocalizations. Goldstein, King, and West (2003) found that adult contingent responses to infant vocalizations at 8 months increased the frequency of infant vocalizations as well as it enhanced the quality of vocalizations. Children were found to have more frequent vocalizations that were more developed, sounded more structured, and were faster in transition than at baseline when they received contingent responses from adults.

Children usually say their first word around the age of one year old; their first word is usually a word that refers to either mother or father such as “mama” or “papa/dada” (Tetzchner, 1993). One reason why is that mothers and fathers are of particular interest to infants and toddlers, as they rely on them for survival, and that children have been exposed to this word often (parents sometimes use mama or dada as a third person when they talk about themselves). The first words children usually learn are nouns and labels for objects or activities (f.ex. “Up” as a way to tell their parents that they want to be held). It is not until children are about 36 months that they use language for more purposes than strictly to get things or attention (Tetzchner et al., 1993). Language is then used to talk about past experiences, as well as for pretend play, which both are important for further cognitive and language development (Damast et al., 1996). Language continues to develop quickly towards the age of five, and after five most children should have a solid basic understanding of sentence structure as well as a wider vocabulary (Foursha-Stevenson et al., 2017). Special interests are important in child development, especially when it comes to cognition and language as children tend to ask more questions about things they are especially interested in (Chouinard et al., 2007).

### **Different perspectives on learning interactions**

Social Learning Theory (SLT) proposes that children learn from the world around them (Bandura, 1977). SLT explains that people and the environment around them are reciprocal factors, given that they both affect each other and that one cannot be explained without the other. According to this theory, children learn behaviors from those around them, and their behaviors are formed by the social interactions they have with their peers as well as with the adults and caregivers that surround them. With the exception of elementary reflexes and physical milestones, behavior is thought to be acquired through direct experience or observation, so that everything that people learn have been taught directly or indirectly from someone else (Bandura, 1977). Thus, during the early years of toddlerhood social interactions with parents are central to children.

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### *Scaffolding*

The ways in which older and more knowledgeable others adjust their behaviors such as verbal and physical instructions to children's developmental level is called "scaffolding" (Wood et al., 1976). Parents use scaffolding when they teach children novel things, behaviors, and actions, when they provide learning support as their children are ready to progress in their learning. With their scaffolding behaviors, the adult or older individual help children to reach beyond what they can do on their own, and thus go past the point of their actual development and into what Vygotsky (1978) defined as the Zone of Proximal Development (ZPD). ZPD is particularly evident in problem solving tasks that are beyond the child's actual developmental level. Although children may not be able to perform the task solely on their own, they might be able to perform the task with the verbal or physical intervention (scaffolding) of an older, more informed teacher (Wood et al., 1976, Vygotsky, 1978).

Sensitivity and scaffolding are closely linked as they are both terms that define the parent's understanding of what their child needs and when they need it (Baumwell et al., 1997; Wood et al., 1976). Scaffolding is viewed as an active aid provided by parents in a learning situation, but scaffolding can also be seen as the ways in which parents interact with their preverbal and verbal children to develop language and communication skills. Scaffolding can therefore be of a bidirectional nature, in which both mother and child together influence the scaffolding that takes place within their interactions (Mulvaney et al., 2006). The child is therefore seen as an active role in the scaffolding-process, and is aware that there is learning taking place.

Scaffolding is prominent in task and problem solving situations. Higher rates of scaffolding have been associated with high levels of child success during independent tasks (Conner & Cross, 1997). Children (12 months) were first asked to build a tower of blocks with the aid of their mothers, and after they had completed the task the children were asked to build the tower without the aid of the mother. Children with higher success rates were children whose mothers were high in scaffolding during the first task.

In specific learning situations and task situations, the purpose is for the child to achieve something, or to complete something, like a puzzle. Many factors play a part in whether children understand what they are supposed to do, and if they are able to perform those acts. The developmental level of the child determines what the child knows and understands. At the same time, many of the learning situations toddlers encounter occur in interactions with their parents or other caregivers (e.g., childcare personnel). As this study

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focuses on the mother-child interaction, the focus will be on these kinds of interactions. Everyday routines and situations involve a tremendous amount of learning opportunities for young children. However, certain situations are specifically constructed for cognitive development and learning, and are representative for the more formal learning situations children will encounter when eventually starting their school trajectories. Understanding how the quality and quantity of maternal input relates to toddlers' learning in such concrete task situations can thus shed light on the most important aspects of child learning. Furthermore, it is beneficial to understand what the most important mechanisms are in these dyadic learning interactions, so that we can focus on these and transfer the valuable information to the interactions where children are supposed to learn so that parents, child care, and schools can implement this knowledge into their teachings.

### ***The current study***

The current study attempts to understand the pedagogical interactions between mother-child dyads in problem solving situations, also referred to as task situations. Observations of dyads in task situations at child age 24 months and 36 months were used to answer the following questions:

1. *Which type of maternal stimulation (i.e. Qualitative input vs Quantitative input) is most related to child task success?*
  - a. *Do mothers stimulate their toddlers differently at age 24 months and at age 36 months?*
  - b. *Is there a link between mother's input and stimulation at age 24 months and children's task success at age 36 months?*

These questions are important as they attempt to specify whether maternal qualitative input or quantitative input can affect child task success in structured task situations, and whether there are differences when it comes to the type of input that is important across time points in toddlerhood. It is important to note that mother-child interactions are important, and they happen quite frequently. However, the specifics of how and when different types of stimuli are more beneficial can also affect how children learn.

### **Methods**

The current study utilizes data from a small sub-sample from the Behavior Outlook Norwegian Development Study (BONDS; Nærde, Janson, & Ogden, 2014), situated at the

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Norwegian Center for Child Behavioral Development (NUBU). The BONDS study is a longitudinal study, including 1159 children and their parents. It is a multi-method study, in which observations, tests, interviews, and questionnaires were employed across multiple arenas where the children spent time, such as at home, kindergarten, and school (Nærde, Janson, & Ogden, 2014). This study will only focus on the structured play observations between mothers and their children. The BONDS study alternated between inviting the mothers and fathers to participate at different ages. However, for a small subsample of families (the double interviews families) both the mothers and fathers were invited to participate in all parts of the data collection, including playing together with their children in structured task situations at 1, 2 and 3 years. The current study included 14 of these mother-child dyads with a focus on one puzzle piece task at both 24 and 36 months. For the purpose of the present study, the video-recordings of the mother-child dyads at 24 and 36 months were transcribed and coded.

### *Participants*

**Table 1.** Sample Descriptives (N=14)

<b>Variables</b>	<b>M (SD)</b>
<b>Age</b>	
Mother age (years)	34.93 (4.95)
	<b>% (n)</b>
<b>Education</b>	
High school/Vocational school (3 years)	21.4 (3)
College/University (<4 years)	28.6 (4)
College/University ( $\geq$ 4 years)	50.0 (7)
<b>Relationship status</b>	
Married – living together	35.7 (5)
Not married – living together	64.3 (9)
<b>First child</b>	
Yes	28.6 (4)
No	71.4 (10)
<b>Currently employed</b>	
Yes	78.6 (11)
No	21.4 (3)

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Half of the toddlers were male ( $N = 7$ ) and the other half females ( $N = 7$ ). Table 1 displays some sample characteristics of the sample and shows that all of the 14 mothers were either married or living with their partners. The majority of the participating mothers had previously birthed a child, which indicates that most of the children had older siblings. Furthermore, 78.6 percent of the mothers reported having received at least some higher education at either a university or a college, which is a high number compared to the Norwegian population in which 55.5 percent of women between the ages of 25-29 have received a higher education or a degree from a university or college (Statistics Norway 2015).

The participants were chosen from a subgroup, through a randomization “program” in excel. However, certain measures were taken to ensure that the genders would be equally distributed in the current study. The different genders of the children were therefore divided, and 7 of each gender were chosen at random, separately.

### ***Structural task situation***

The structured task situations were specifically designed for each age group. Each of the tasks employed in this study is constructed so that they are a little too demanding for the child to accomplish and solve on their own. Thus, the tasks are designed to elicit help from the mothers. This allows us to see in a larger context the ways in which mothers strategize, and utilize “scaffolding” as a pedagogical tool in interaction with their children.

All of the mothers were given the same instruction in the beginning of each task (a puzzle). They were instructed to feel free to help their child in any way they deemed appropriate, and there were no specific instructions in how to complete the task at hand. Mothers could therefore help or not help as much as they wanted. For each task the dyads were allocated 3 minutes. The interviewer underlined that they did not have to complete the task, and that they were free to do the same puzzle over again if they had time to spare. The situations were videotaped in order to capture all communication between child and mother, without intervention.

The tasks selected for this particular study were at both time points “puzzles”. The task selected at 24 months is a wood puzzle with a picture of a farm with different animals and objects on it. The goal is to place each puzzle piece into their respective spots on the puzzle board. The pieces have small handles on them to make it easier for the children to hold on to the pieces and place them with the right side up on the board (see Appendix A for picture of the two-years puzzle).



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When the mother-child dyads returned for the 36-month observation, the task was to successfully put together a muffin top and bottom, and then place the complete muffin into its correct spot on the muffin tray. Each muffin top has a patterned hole, such as a flower or a square; these muffin tops then have a respective muffin bottom with the same pattern on it. Only the muffin top and muffin bottom with the same pattern will be able to fit together, and make a complete muffin. Similarly, each spot on the tray has a particular pattern at the bottom for which a particular muffin fit (see Appendix A for picture of the three-years puzzle).

### *Transcription*

The 28 videotapes were transcribed for all verbal communication utilizing a computer program called Computerized Language Analysis (CLAN) (MacWhinney & Snow, 1990). There was a clear distinction between verbal utterances from the mother versus the child as they received their own main tier-line with its own color in the CLAN program. In addition, gestures, task-related actions, and additional contextual information (such as positioning in regards to the camera) were transcribed on separate dependent tiers. Each of the 28 transcripts also included participant numbers, the date the video was recorded, as well as when the structural play situation started and ended. The last aspect was especially important as the dyads were only given 3 minutes to complete each task, thus the amount of time given to each dyad had to be almost identical. Only information pertaining to the task situation was transcribed. If there were additional sounds or inadequate sound (e.g., baby crying in next-door room), making it difficult to hear particular utterances, this was noted on commentary lines. If it was difficult to hear what the mother or child was saying (e.g., the child whispered), the unintelligible speech was transcribed as xxx.

### *Reliability*

**Table 2.** Inter-rater reliability (in percentage, all transcripts and M)

Transcript	# utterances	# utterances	#words	#words	# questions	#att	#suc
	mother	child	mother	child	mother		
Nr 1	97.40	95.12	99.71	84.62	100.00	94.44	85.71
Nr 2	100.00	89.74	96.63	93.88	77.78	66.67	100.00
Nr 3	98.46	95.35	98.89	76.47	57.89	91.67	100.00
Nr 4	95.95	89.29	97.75	89.01	76.19	75.00	91.67
<b>Mean %</b>	<b>97.95</b>	<b>92.38</b>	<b>98.24</b>	<b>85.99</b>	<b>77.97</b>	<b>81.95</b>	<b>94.35</b>

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The study uses 28 transcripts of 14 mother-child dyads at two separate time points. Ten mother-child dyads at the two time-points (20 transcripts) were already transcribed by Imac Zambrana (NUBU) as part of a pilot study she was undertaking at the time. Four of these transcripts were then transcribed again by the current author in order to determine reliability for the present study. Furthermore, four additional mother-child dyads were transcribed at the two time-points by the author. Thus, of the 28 transcripts used for this study, 14 percent were double-transcribed and I transcribed 12 transcripts altogether.

Some discrepancies were discovered with regard to spelling. This was adjusted for by counting the number of words and not the exact ways in which things were spelled. Another difficulty that has to be accounted for was that the first and second transcriber had a different understanding of how onomatopoeias were spelled, and therefore these were not counted at all as words in the current study. Onomatopoeias were given their own “sub-tier” and were given the “back code” of @o in CLAN. They were therefore easy to remove from the final result. The lowest reliability score was 77.97% for number of questions made by mother. A possible reason for the discrepancy could be that the first and second transcriber had different understandings of the tone used by the mother or child, and therefore one of them may not have coded/transcribed the verbal communication as a question, whereas the other might have. The highest reliability score was reached in the number of utterances the mothers had with a mean of 97.95%. Overall, due to the small sample size, the reliability score is appropriate and deemed very good with a majority of scores showing above 90% agreement (see Table 2 for detailed overview).

### ***Measures***

#### *Coding of child task performance in CLAN*

Each of the transcripts was also independently coded for task attempts and successes. An attempt and a success were coded and defined a little different for the two age groups. For the 24-month task, an attempt was defined as an intentional, individual attempt to place a puzzle piece into a spot on the puzzle board. An attempt could only be coded once, meaning that the child had to change strategies or change the spot they were trying in order for it to count as a new attempt. If the child managed to place the correct puzzle piece into its respective spot on the puzzle board, the action was coded as a successful act.

The 36-months task situation included more potential “successes” than the 24-months puzzle. Attempts were coded in a similar fashion, and the child’s action was coded as an

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attempt if the child tried to fit a muffin top to a muffin bottom without luck. However, placing a complete muffin into the wrong spot on the muffin tin would also be coded as an attempt. Attempts had to be intentional and were only coded once per individual attempt. If the child tried a new bottom or a new spot on the tin, it would count as a separate attempt. If the attempts were correct, they were coded as successes.

### *Quantitative measures of maternal input*

The CLAN program calculated the mean length of each utterance (MLU), the number of statements, and number of questions in every transcript.

### *Qualitative ratings of maternal input*

In addition to data derived from the task situations, sensitivity and cognitive stimulation ratings were extracted from “Qualitative Ratings for Parent-Child Interaction Ages 2-4” test (Caughy & Owen, 2015 in Nordahl, Zambrana, & Forgatch, 2016). Sensitivity and cognitive stimulation during the structured task situations at both 24 months and 36 months had already been rated by trained assistants as part of the overall BONDS study.

*Sensitivity/ Responsiveness.* Sensitivity, with regards to parenting, can be defined in various ways. However, the key aspects are roughly the same. Availability, trustworthiness, and predictability are qualities that are in focus (Ainsworth et al., 1972). For the purpose of this study sensitivity is defined, through the “Qualitative ratings for parent-child interaction ages 2-4 years” used in the Dallas Preschool Readiness Project (Owen et al., 2010). It is defined as the ability a parent has to observe and respond to their child’s “social gestures, expressions, and signals,” and the ways in which parents appropriately respond to these social cues. The scales that are utilized in this study focuses on the appropriateness of the mother’s responses in terms of their child’s behavior and apparent needs during the situation at hand.

The key characteristic of sensitivity, especially in this rating system, is that it is child-centered. The system works on a 1-5-point scale, where 5 indicates that a mother has a high score in sensitivity. Thus, the higher the score the more appropriate and responsive the mothers are in the interaction with their children. The sensitive mothers therefore never under-estimate their child’s capabilities, nor over-estimate them, and facilitate interactions that are suitable for the child. They also understand how much help their child needs during a task, and what they can accomplish with scaffolding and on their own (Owen et al., 2010). A

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parent that receives a poor score on the sensitivity scale might not understand their child's needs, or not themselves understand when the child needs more help or when to switch activities in order to properly respond to their child.

According to Owen et al. (2010) a mother that receives a score of one on the sensitivity rating will therefore be categorized as “not at all characteristic” of the “rules and requirements of sensitive parenting.” These parents are either intrusive or detached when it comes to interacting with their children. They rarely respond appropriately to their child's needs, and when they do their interactions are at the wrong time or inappropriate. These mothers are characteristically involved in adult-centered interactions, as they do not understand how to respond to their child's signals, gestures, moods, interests, and needs. A score of two means that the mother meets minimal characteristics of sensitivity. These parents display weak or infrequent sensitivity during the task situations. They also appear more unresponsive than responsive to their children's needs, signals, gestures, moods, and interests. Parents who display somewhat characteristic traits of sensitivity are given a score of three. These mothers “can be sensitive to the child, however the parents' behaviors may be mechanical in quality and ill-paced” (Owen et al., 2010). Predominantly sensitive parents are characterized as “moderately characteristic,” as they for the most part respond to their children appropriately and at the right time, however there are a few times where the child does not receive the right response or the response is delayed. These mothers receive a score of 4 on the sensitivity/responsiveness scale. The mothers who respond quickly and appropriately to their children's signals, gestures, needs, moods, and interests receive the score of five in the parent-child rating scheme developed by Owen et al. (2010). They are rarely or never insensitive or nonresponsive to their child, and responses are “prompt and in-sync” with their child's needs.

The inter-coder reliability estimates for this rating scale at 24 and 36 months were .80 and .79, respectively.

*Cognitive Stimulation of Development.* Another aspect of the Qualitative rating system used in this study is the “Cognitive Stimulation of Development” scale (Owen et al., 2010). This scale measures the facilitation of the mothers when it comes to fostering the child's development during the task situation. Similarly, to the sensitivity/responsiveness scale, the cognitive stimulation scale is measured on a 1-5-point scale. Mothers are scored on the ways in which they facilitate the child's learning, development, and achievement. For example, mothers who encourage and engage in pretend play with their children, present activities in an organized manner, elaborate and relate play activity to the child's own experiences are high

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on the cognitive stimulation of development scale. This score is measured in a similar manner to the sensitivity scale.

A score of one indicates that the mother did not achieve to stimulate the child in a characteristic fashion. There is little stimulation present, and the mother does not seem to attempt to teach their child much of anything. In addition, the parents who receive the score of one are typically silent, and the efforts they do make to stimulate their child are characterized as being inappropriate. Parents or mothers who are infrequent in their stimulation of their child, and have limited attempts to purposefully and intentionally teach their children anything receive a score of two. Mother may also receive a score of two if they only spend a brief period of time (out of the 3-minute interaction with the child) in “high-quality interactions with the child.” Three, indicates that the mother does make somewhat of an effort to stimulate her child, however, these attempts might not be categorized as the mother’s main agenda, as well as the attempts might be inconsistent. Mothers in this category do not take advantage of every opportunity of stimulation that occur, and the few opportunities and attempts they do take are often repetitive and sometimes unsuccessful. Parent who have a clear agenda, and provide adequate stimulation to their children, but could “reasonably be expected to provide more and higher-quality stimulation” in the task situation with their child receive a score of four. These mothers find new ways to engage their children, and noticeably have a stimulation agenda, however, they may fail to take full advantage of every stimulation opportunity that occurs. The score of five is given to mothers who are consistent and in their stimulation, and take advantage of toys and activities as means to stimulate and teach their children. To receive this score, the mothers vary in the ways in which they stimulate their child. The primary intent for stimulation is teaching and fostering development, and these mothers provide rich stimulation to their child in terms of language and movement. The score of five is given to parents who are “exceptionally advantageous” in their stimulations.

The inter-coder reliability estimates for this rating scale at 24 and 36 months were .74 and .72, respectively.

### *Analysis*

All data was analyzed in SPSS 24 (SPSS Inc., 2016). The first analysis performed was a descriptive analysis of all the variables where mean and standard deviation was estimated. Both frequencies and descriptive data are shown in Table 3 in the results section. Secondly, a

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bivariate correlation analysis was performed using the correlation coefficients in order to attempt to determine the strength of the relationship between the variables.

### Results

#### *Descriptive results*

Mothers produced plentiful amounts of utterances throughout, although the structural task situations only lasted 3 minutes. As shown in Table 3, mothers on average had over 80 utterances at 24 months, of which 25.7% were questions. Even though mothers in general had fewer utterances at 36 months, 25.0% of the utterances were still questions. This shows that mothers asked almost exactly the same percentage of questions despite the age development of the children.

**Table 3.** Descriptives (N = 14), mean (M) and standard deviations (SD)

Variables	M	SD
<b>24 months</b>		
Mother utterances	83.79	21.64
Mother questions	21.57	7.00
Child utterances	31.29	9.99
Child MLU	1.37	0.34
Child Task Attempts	15.00	4.82
Child Task Success	9.50	4.01
Sensitivity/Responsiveness	3.57	.756
Cognitive Stimulation	3.14	.864
<b>36 months</b>		
Mother utterances	58.86	18.84
Mother questions	14.71	6.93
Child utterances	32.07	12.62
Child MLU	1.96	0.39
Child Task Attempts	5.00	2.63
Child Task Success	8.57	3.23
Sensitivity/Responsiveness	3.71	.469
Cognitive Stimulation	3.14	.535

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One of the most interesting things when it comes to the descriptive statistics, is that children on average had more successes at 24 months than at 36 months. There were more chances to receive more “task successes” at 36 months than at 24 months, as the muffin puzzle was more complex. However, many of the children finished the puzzle more than once. They seemed to also need multiple attempts per success as there were more failed attempts at 24 months than at 36 months in general. One aspect that was expected was that children at 24 months would have more attempts than children at 36 months.

Sensitivity/responsiveness and cognitive stimulation stayed stable across the two time points. The mean score of sensitivity/responsiveness was slightly higher at 36 than at 24 months, while the means for cognitive stimulation were the same at the two time-points, although the variation as depicted by the SD suggest somewhat larger variance at 2 years. Figure 1 and 2 show the mean numbers of some of the descriptive information with the error bars included.

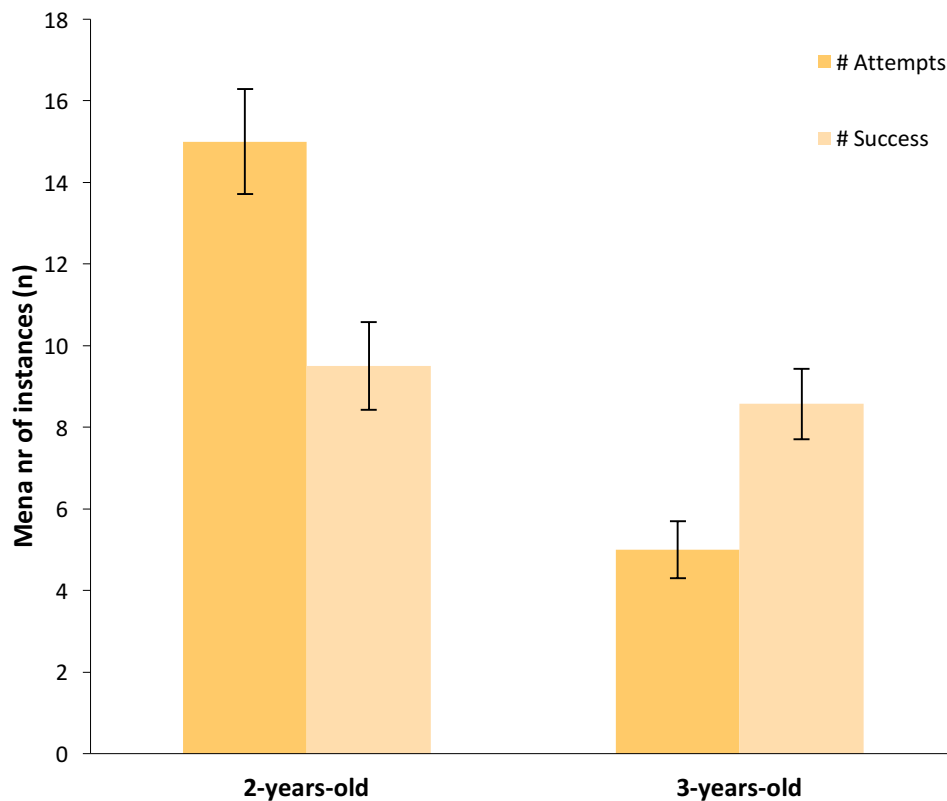


Figure 1. Child factors (with error bars)

Figure 1 show that more failed attempts were made at 24 months when compared to at 36 months. Furthermore, more successful attempts were also made in the 24-month task than during the 36-month task situation. Thus, fewer failed attempts were made at 36 months, and

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the children clearly had more successful attempts overall than they had failed attempts at 36 months. As the error bars for the attempts do not overlap, this difference between the two time-points is significant.

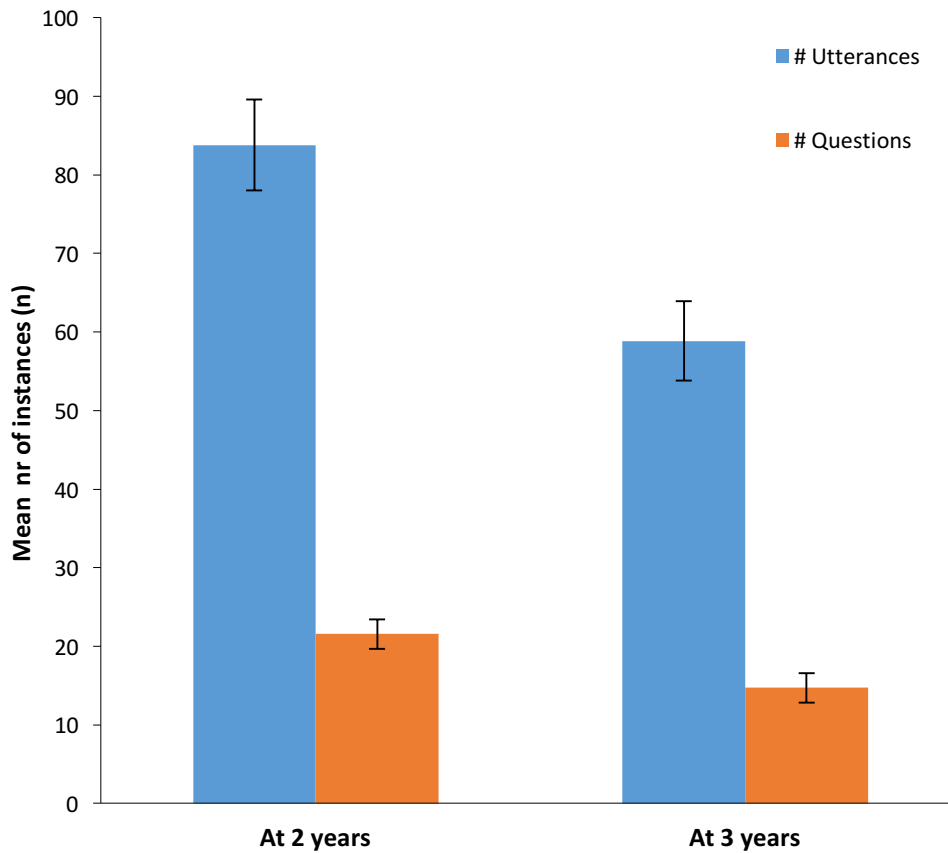


Figure 2. Mother factors (with error bars)

Figure 2 illustrates the differences between the mother variables “mother utterances” and “mother questions” at 24 months and 36 months. As shown in the figure mothers generally spoke a lot during the three minutes that were allocated to the task situations. Mothers, specifically, spoke significantly more at 24 months than they did at 36 months. Mothers also asked more questions at 24 months than did at 36 months. As previously mentioned, however, about 25 percent of the mother utterances were questions at both time points.

### ***Correlation and predictive results***

Bivariate correlation analyses were performed in order to examine how the mothers’ verbal, sensitive, or cognitive cues were related to each other and to child success and attempts. The results are presented separately for relations 1) across time, within person, 2) across time, across person, 3) within time, within person, and 4) within time, across person.



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It is important to note that more results than the ones presented may be significant, and that more variables may be related to one another. However, due to the small sample size the results presented here are only the relations that were found to be significant or highly likely to be significant (given larger sample) in the correlation analysis. Results are deemed significant at  $p < .05$  and  $p < .005$ . However, as previously mentioned the sample is small, and therefore some correlations are marked with † in order to indicate that these correlations are likely to be significant with a larger sample, and are only significant at a  $p < .10$  level.

### *Correlations across time, within person*

First, relations between mothers' behaviors over time were examined, to see whether mothers are consistent in their behaviors over time. Mothers' utterances at 24 and 36 months were positively correlated ( $r = .537, p = .048$ ). Furthermore, mothers' utterances at 24 months were negatively correlated with their sensitivity at 36 months ( $r = -.471, p = .089$ ). Mothers' sensitivity was correlated across time ( $r = .529, p = .052$ ), which indicates that sensitivity is a relatively stable measurement. Cognitive stimulation at 24 months, is highly positively correlated with mothers' utterances at 36 months ( $r = .737, p = .003$ ), and correlate at a  $p < .10$  level with mother's questions at 36 months ( $r = .506, p = .065$ ).

Secondly, the child behaviors across time were analyzed. Children's successful attempts at 24 months and 36 months correlated  $.555 (p = .040)$ , which means that the same children who succeeded at 24 months are in large part the same children who succeed at 36 months. Furthermore, although not significant, child success at 24 months and children's failed attempts at 36 months, were found to negatively correlate ( $r = -.450, p = .107$ ).

### *Correlations across time, across person*

Few correlations between mothers' behaviors at 24 months and children's behaviors at 36 months were significant, but all were positive, except for a negative correlation between utterances and sensitivity (not significant). Of note is that there was a strong correlation between mother's amount of utterances at 24 months and children's failed attempts at 36 months ( $r = .604, p = .022$ ).

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**Table 4. Correlation matrix**

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
1. Mother utterances (24)	-	-	-	-	-	-	.048	-	.089	-	.022	-
2. Mother questions (24)	.367	-	-	-	-	-	-	-	-	-	-	-
3. Sensitivity (24)	-.208	.171	-	-	-	-	-	-	.052	-	-	-
4. Cognitive Stimulation (24)	.455	.211	.285	-	-	-	.003	.065	-	-	-	-
5. Child Attempt (24)	.404	.087	-.178	.028	-	-	-	-	-	-	-	-
6. Child Success (24)	-.246	-.326	-.226	.150	.027	-	-	-	.099	-	-	.040
7. Mother utterances (36)	.537*	.139	.134	.737**	.131	-.058	-	.008	-	-	-	-
8. Mother questions (36)	.351	.395	.022	.506†	.347	-.291	.679**	-	-	-	.032	-
9. Sensitivity (36)	-.471†	.177	.529†	.125	-.315	.458†	-.059	-.216	-	.090	.031	.073
10. Cognitive Stimulation (36)	.064	.402	-.019	.278	-.092	.194	.300	.394	.470†	-	-	-
11. Child Failed Attempt (36)	.604*	.301	-.369	.264	.126	-.450	.320	.573*	-.577*	.350	-	.016
12. Child Successful Attempts (36)	-.255	-.088	-.097	-.087	.067	.555*	.096	-.284	.494†	.011	-.628*	-

Note. (24) specifies that the data was collected when the child was 24 months, and (36) means that the data was collected at 36 months. Significant *p* values are noted on the top.

† *p* < .10

\**p* < .05

\*\**p* < .005

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### *Correlations within time, within person*

No significant correlations were found between the mother variables at 24 months. However, as the correlation table shows there was a high correlation between mother's questions and mother's utterances at 36 months at  $r = .679$  and  $p = .008$ . With a larger sample size, the correlation between maternal sensitivity and cognitive stimulation at 36 months would likely have reached a more robust  $p$ -level too ( $r = .470$ ,  $p = .090$ ).

The children variables, failed attempts and successful attempts were not related at 24 months ( $r = .027$ ). However, at 36 months, the two variables were strongly yet negatively correlated ( $r = -.628$ ,  $p = .016$ ).

### *Correlations within time, across person*

Lastly, the study looked at the correlations between child and mother behaviors within the same time point (24 months and 36 months). Although no significant relations between the mother and child variables at 24 months were found in the current study, this does not mean that there is no relation, merely that none were found with this sample and sample size

The most interesting results were found between mothers and children behaviors in the 36-month section of the study. Mothers' amount of questions and children's amount of failed attempts were positively related ( $r = .573$ ,  $p = .032$ ), while sensitivity and failed attempts were negatively related ( $r = -.577$ ,  $p = .031$ ). Furthermore, in a larger sample size, sensitivity and child's successful attempts at 36 months, would likely correlate as they are significant at the  $p = < .10$  level ( $r = .494$ ,  $p = .073$ ).

## **Discussion**

The current study attempted to address whether qualitative input or quantitative input was most related to task success in a problem solving interaction between mothers and their children at 24 months and 36 months. Qualitative input as a whole was found to have a more positive relation to task success than quantitative input, whilst quantitative input was found to have a more negative relation to failed attempts compared with qualitative input. Secondly, the study looked at the difference in stimulation strategy mothers choose at the different ages (time points). Mothers spoke more in general when their children were younger, and they also asked more questions at 24 months than they did at 36 months. Maternal sensitivity and cognitive stimulation stayed very stable as a mean measure, as well as they appear to correlate with one another. Lastly, the study looked to find an association between mother's input at 24

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months and child task success at 36 months. There were few associations found in the current study, however, quantitative input at 24 months was highly correlated to child failed attempts at 36 months. Overall, sensitivity was found to be the most promising maternal indicator of child *task success* at 36 months in the current study.

### ***Qualitative input during task situations***

Qualitative input ratings were found to be quite stable across time albeit there seems to be a very low correlation between cognitive stimulation at 24 months and cognitive stimulation at 36 months (Table 4). This indicates that mothers tested slightly differently in the cognitive stimulation rating during the first and the second task situation. Much like Ainsworth, Bell & Stayton (1972) the current study also found that sensitivity is a stable rating longitudinally within a mother-child dyad.

Although there were low correlations longitudinal in terms of cognitive stimulation, the low correlations may be due to measurement error, small sample, or the ways in which cognitive stimulation changes with the maturation and age of the child. There might be different aspects of cognitive stimulation for some children as they might be further ahead in development than the norm, or they might not have reached their full potential yet. One would think that there would be a clear correlation between maternal sensitivity and cognitive stimulation, however, only at 36 months were the two likely to correlate given a larger sample. This underlines that the two qualitative input factors are separate entities that provide different information, and are not overlapping factors. The low correlation could also potentially be due to the nature of cognitive stimulation. Cognitive stimulation captures more of what could be characterized as strictly language input and therefore children's language skills could have a determining factor when it comes to how much of the cognitive stimulation they are able to utilize or understand (Damast et al., 1996).

### ***Quantitative input during task situations***

Quantitative defined as number of utterances correlated highly within the mothers over time. This indicates that the mothers who spoke the most during the 24-month task, were the same mothers who spoke a lot during the 36-month task (table 4). The amount of questions asked during the two different tasks were found to amount to approx. 25% of the maternal utterances in both tasks. However, the number of utterances at 24 months and 36 months were not correlated with one another. This could mean that different mothers asked questions at the

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two time-points. However, the overall trend when it comes to quantitative input provided by the mothers in this study is that mothers, in general, had fewer utterances at 36 months than they did during the task situation at 24 months. This was expected as the study sought to see whether mothers spoke more, gave more instructions, during the 24-month task situation than during the 36-month situation. Although it seems like mothers produced many utterances during the 3-minute task situations, it is important to note that this is in tune with research on CDS. Yet, CDS includes repetition as well as short utterances (Foursha-Stevenson et al., 2017), which are not separated in the current study. This repetition could also be a factor in the correlation between maternal questions and maternal utterances at 36 months. The mothers that spoke the most also asked the largest amount of questions. Whether the utterances are repetition or not would be interesting to examine further as it could shed a light on whether it is merely the amount of verbal input the children receive that contributes to the results in the current study or if repetition in itself could be a contributor.

In addition, mothers in the current study were, in general, high in sensitivity and cognitive stimulation, this is important in terms of quantitative input as mothers who score high on these two characteristics also speak more to their children overall (Onnis, 2017). In tune with that, mothers in the current study did in fact have a high amount of utterances during the task interaction.

### *Qualitative vs. Quantitative input*

Cognitive stimulation at 24 months was highly correlated with maternal utterances but not maternal questions at 36 months. This implies that cognitive stimulation is associated with the overall quantity of language input, but not the quantity of a certain type. One example of how these two are intertwined is that mothers who continue to talk about and broaden the vocabulary about an object in the task situations could have a higher rating in cognitive stimulation, but they would therefore also have an increase in amount of utterances. Cognitive development has been positively linked to parental communication that focuses on challenging their children as well as supporting them in order to provide learning opportunities for their children (Rowe, 2012). In doing so, mothers might speak more as they are focused on providing verbal support and challenges, which essentially might have raised the number of utterances mothers spoke in the current study.

On the other hand, mothers with a high amount of utterances at 24 months tended to show a lower score of sensitivity at 36 months (not significant). This may suggest that mothers who support their child, and know what they need, speak less in task situations than

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mothers who might not understand their child's needs as well (Bornstein & Manian, 2013). This is important to note as sensitivity is in a way the understanding of your child's needs and how to best meet those need, some mothers might therefore misunderstand their children's needs and implement more verbal input on them than they might need (Ainsworth et al., 1972; Mulvaney et al., 2006). A consideration is that large amounts of verbal input and information might overwhelm a child, and might therefore create more misunderstandings than clarity when it comes to solving the task. Thus, sensitive mothers might have a larger focus on appropriateness and responsiveness than mothers who score lower on the sensitivity scale (Bornstein & Manian, 2013).

### *Child task success related to maternal input*

The most interesting finding in the current study was that mother's questions at 36 months and child failed attempts at 36 months were highly positively correlated. This also means that in this task situation, quantitative input in the form of questions were not helpful for scaffolding a child towards task success, but might be something mothers turn to when the child struggles. Alternatively, this could mean that although questions are considered to have a positive effect as they challenge children more in everyday life and stimulate them in language development (Chouinard et al., 2007), questions might not be as conducive to task success. Questions might be more of a distraction from the task than an aid. It is important to note that the contents of the questions were not differentiated in this study, and that we therefore do not know if for instance task-relevant questions were conducive and task-irrelevant questions were a "distraction." Furthermore, maternal sensitivity and the child's failed attempts at 36 months were negatively correlated. This means that mothers who scored low on the sensitivity scale were more likely to have children who made the most failed attempts at 36 months. Contrary, given a  $p$  value of .1 for the correlation between child success and maternal sensitivity at 36 months would have been significant, suggesting that sensitivity at 36 months may be the strongest maternal input indicator of child success at 36 months in such task situations. Potentially sensitive mothers understand their children and know how important it is to provide them with adequate input and information (Bornstein & Manian, 2013). They understand their children, and might therefore see things from their perspective and consequently understand where the problem lies. Accordingly, mothers who score highly on sensitivity might see where the child is stuck, and know what information to provide in order to help the child towards success (Baumwell et al., 1997; Mulvaney et al., 2006).

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### *Limitations to the current study*

First of all, a profound limitation to the current study is the small sample size. The results suggest that more participants would have provided more statistical strength to the results. Another related issue is that our participants were homogeneous in the sense that they were all well-educated mother, with more than one older child, who were all working. A more diverse sample would better represent the Norwegian community. Recruitment from other parts of Norway and from different cultures would have changed the make-up of the sample. Low variability within the sample can both make it difficult to detect relations that are there in a more diverse sample, as well as yield correlations based on the extreme values.

As the observations were not specifically created for the purpose of the current study, there were some limitations when it came to method and analysis. Firstly, there was a time limit to the structural observation task of three minutes. The results may therefore have been affected by time pressure even though parents were told to disregard the time and not worry about whether the children got the task right or not, and specifically if they finished the puzzle or not. However, parents may have felt the pressure despite being told not to worry about the results. Although many things and aspects of daily life is affected by the “lack of time” that people around the globe experience in everyday life, we were not able to control for the effect the time limit had on the results and interactions between parent and child.

The current study changed its ways underway which might have affected the ways in which things were resolved through out. The study could have benefited from dividing verbal input and questions into task-relevant and not-relevant categories in order to provide more specific measures in the quantitative section of the study. However, this was not possible to do, due to time limitations.

### *Conclusion*

The current study found some evidence that suggests maternal sensitivity to be an important type of input when it comes to child task success in problem solving situations. Cognitive stimulation and quantitative input was not found to be conducive to child task success in this study. However, the results suggested that quantitative input is more related to children’s failed attempts than to children’s successful attempts, while the qualitative input the mothers provided was found to be more related to task success than quantitative input, but only concurrently at 36 months.

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The current study emphasizes the importance of face-to-face interactions in learning situations within mother-child dyads. Parents in today's society are preoccupied with technology and the constant documentation of experiences and milestones their children accomplish that some aspects of the parent-child interaction might be suffering. This is important to note as research has found that mothers who were preoccupied with mobile devices had lower levels of verbal and nonverbal communication with their children compared to mothers who were not preoccupied with devices in a structural task (Radesky et al., 2014). The interference from mobile devices is particularly relevant as technological advances are blooming like never before. However, it is important to state that research should look further into the effects of mobile devices in problem solving situations in order to emphasize the validity of mother-child interactions that are child-centered and sensitive in nature, and not only focus on the negative effects technology might entail. Children start to learn how to navigate technological devices from a young age and there are beneficial attributes to this; however, technology cannot not replace the parent-child interaction that promotes learning and sense of achievement in a child. This being said, the current study does not address the interference of mobile devices and further research should be done in order to investigate the effects of technology on task success in problem solving interactions.



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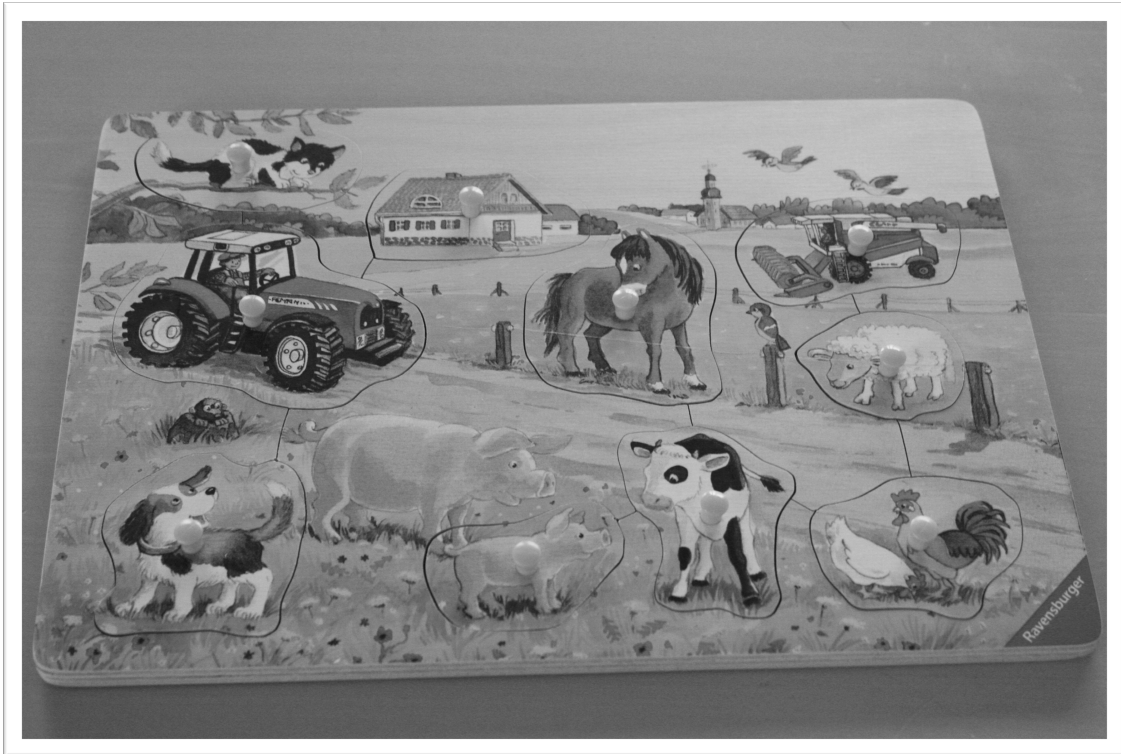
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## Appendix A

Picture of the structured task at 24 months



Picture of the structured task at 36 months

