



<b>Title</b>	<b>Relationships between some maternal variables and lexical diversity in three-year-old Cantonese-speaking children</b>
<b>Other Contributor(s)</b>	<b>University of Hong Kong.</b>
<b>Author(s)</b>	<b>Tang, Chung-yan, Joyce</b>
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Relationships between Some Maternal Variables and Lexical Diversity  
in Three-year-old Cantonese-speaking Children

Tang Chung-yan, Joyce

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**Abstract**

This study examined the relationship between mothers' lexical diversity, questioning style, education level and children's lexical diversity. The subjects were 85 Cantonese-speaking mother-child pairs. The children ranged from 37 to 52 months of age. Language characteristics of the mothers and children were analyzed from conversational samples that spanned for about 10-minutes. Maternal lexical diversity and maternal questioning style were found to be mildly correlated with the children's lexical diversity. Correlations of maternal education and child age with lexical diversity were not significant. Maternal lexical diversity and maternal questioning style together significantly predict 23.2% of the children's lexical diversity. Possible explanations for the results were discussed.

## Introduction

Children acquire about 10 new words a day, giving rise to a vocabulary size of 14000 at age six (Clark, 1993). Words are the basic elements for subsequent syntactic development. Bates, Dale and Thal's (1995) discussed Fenson et al.'s study (1994), which investigated relationship between vocabulary size and grammar in 1800 English speaking children between eight and thirty months. For most of the children, word combination emerges when children reach a vocabulary size between 50 and 200 different words.

### *Variables related to lexical development*

Fenson et al. (1994) reported large individual variations in vocabulary size across children. Thirty-month-old children at the median produced around 550 words, while same-aged children at the 10<sup>th</sup> percentile produced only around 300 words. Both individual and environmental variables contribute to individual variations in vocabulary size. Klee, Stokes, Wong, Fletcher and Gavin (2004) reported child age as an individual variable highly correlated with lexical diversity in their study on seventy-four Cantonese-speaking children of age 27 to 68 months. Significant curvilinear relationship  $r=0.73$  between child age and lexical diversity was revealed. Duran, Malvern, Richards & Chipere's study (2004) conducted a study on 212 English-speaking children of age 18 to 42 months. Significant developmental trend

was also reported.

On the other hand, environmental variables may also contribute to individual differences in vocabulary growth. These may include the family's socioeconomic status, the availability of economic resources and parental educational history. For instance, Hart and Risley's (1995) longitudinal study investigated forty-two English speaking children across three socioeconomic status groups from 10 months to 36 months. The rate of vocabulary growth was significantly correlated with the family's socioeconomic status. Families with a high socioeconomic status potentially have easier access to materials, such as toys and books, that would facilitate children's language learning. Differences were also observed in the variability in the parents' vocabulary, grammar use and sociability across the three socioeconomic status groups (Hart & Risley, 1995). Another environmental variable, maternal educational level, was found to be positively correlated with early language development in a study of 241 English speaking three-year-old children across three maternal education level groups (Dollaghan et al., 1999). Number of different words in children's spontaneous language production increased significantly with increasing maternal education level. Maternal education level acts as a nonmaterial resource to provide the children with their academic competence, knowledge and beliefs about child development.

Acquiring words in one's ambient language is a process of learning from

experience. When children are exposed to a new word, they fast map the word onto a referent. In order to complete the lexical entry, however, children need to appreciate the whole meaning of the word through extended exposures (Clark, 1993). Between two parents, the mother is generally the one young children spend most of their time with. Mother's language use during conversation and interaction with their children serves as a primary source of input for children's early language learning experience. Thus, maternal language input has an important role and it is plausible that some of the characteristics of maternal speech may have an effect on children's vocabulary development.

In Pan, Rowe, Singer and Snow (2005) and Rowe, Pan and Ayoub's study (2005) using the same pool of 146 American children from age one to three, reported great variation in the mother's diversity of lexical input. The number of different words produced by the most talkative mother was eight times more than that of the least talkative mother in a ten-minute interaction. Pan et al.'s study (2005) also reported diversity of maternal input had a significant positive main effect on the growth of children's vocabulary production.

Another characteristic of maternal speech involves the maternal questioning styles. Donahue-Kilburg (1992) described how open-ended questions could be answered in various ways and therefore suggested that they should facilitate language

learning. In Rowe, Pan & Coker's (2004) study, differences between fathers' and mothers' talk to their two-year-old children in thirty-three American low-income families were examined. The study showed that fathers asked more wh-questions and clarification requests when compared with the mothers. And the children used significantly more diverse vocabulary with their fathers. This showed the use of wh-questions had a positive effect on child lexical development.

There is solid evidence reported on the effects of different maternal variables in English-speaking children. Johnston and Wong (2002) studied the beliefs and practices of 42 Chinese and 42 Western mothers. They discussed the belief of the same speech characteristics can be cultural specific across different cultures (Johnston & Wong, 2002) and thus the characteristics are plausible to have cultural specific effects on child's lexical development. Therefore, it is necessary to examine whether some of these maternal variables have similar effects on Cantonese-speaking children. In this study, we will examine maternal lexical diversity, questioning style and education level. A child variable, age, was included in this study to examine its relationship with lexical diversity. Such relationship has been reported in English as well as in Cantonese-speaking children. The following research questions were asked:

1. To what extent the maternal lexical diversity relates to child's lexical diversity?
2. To what extent the maternal questioning pattern relates to child's lexical diversity?

3. To what extent the maternal education level relates to child's lexical diversity?
4. To what extent the age of child relates to child's lexical diversity?
5. How much variance of the child's lexical diversity can be accounted for by maternal lexical diversity, maternal questioning pattern and maternal education level?

## Method

### *The database*

This study made use of a language sample database which was collected for a longitudinal study on the development of early literacy in Cantonese-speaking children. These language samples had been used in two earlier studies (Chow, 2005; Hon, 2005) examining the development of the locative marker *hai*<sub>2</sub>, and *bei*<sub>2</sub> “give” dative constructions in young children.

Twelve language samples from the database were excluded. They were samples of conversation between children and their fathers or other caregivers, samples included less than 40 child or mother utterances and such a small sample was not reliable for the calculation of D (MacWhinney, 1995) and analysis of maternal questioning pattern, samples involved the heavy use of Japanese and Japanese is a minority foreign language in Hong Kong.

### *Participants*



Samples from 85 mother-child pairs were eventually included in subsequent analyses. The children group consisted of 46 girls and 39 boys, aged between 37 to 52 months of age. All participating children and mothers were reported to be Cantonese native speakers and the children were typical in their language ability.

### *Procedures*

The language samples were collected when the children engaged in conversation with their mothers in their own homes. The mothers were asked to play and speak with their children as they would without presence of the research assistant. The mother-child pairs were provided with the same standard set of toys, including a cook set, some building blocks and two cars, in order to facilitate talk and play with each other. The samples lasted for ten to fifteen minutes, with a range of 45 and 165 child utterances, and 50 and 333 mother utterances. All samples in the database were first transcribed orthographically from audiotapes by a group of trained research assistants. The transcripts were then entered into computer text files in CHAT format of the Children's Data Exchange System (MacWhinney, 1995). A group of trained research assistants agreed on a set of transcription, coding and morpheme segmentation guidelines before the transcription to ensure transcription accuracy. These research assistants standardized the phonetic variants and segmented the morphemes for all of the child's utterances in each transcript. The author of this study

did the same for all of the mother's utterances in each transcript.

#### *Reliability of transcription*

The author independently re-transcribed three audiotapes that were selected randomly from the eighty-five tapes. Reliability was determined on a morpheme-by-morpheme basis. Percentage correct of the number of morpheme in the utterances was calculated using the original transcription in the database as the standard. The level of agreement between the two transcribers was 94.6 %.

#### *Exclusion of English utterances*

Complete English utterances from the children and the mothers were excluded from this study, but isolated use of English words remained. As Hong Kong is a bilingual city and children are exposed to English early through preschool or their domestic helpers, it is not common for Cantonese-speaking children and mothers to switch between Cantonese and English within an utterance.

#### *Measures of Lexical Diversity*

To investigate the children lexical diversity, lexical diversity (D) was chosen over total different word (TDW) and type token ratio (TTR) in this study. In Klee, et al.'s study (2004), a significant curvilinear relationship between lexical diversity (D) and age with  $r=0.73$  was reported in a group of seventy-four Cantonese children with age 27 to 68 months. Lexical diversity of children's conversation language thus

significantly related to age. Therefore, it is a good indicator for one's language development. Increase in D would represent increase in lexical diversity. TDW and TTR were not chosen as indicator of lexical diversity because number of words in language samples had to be controlled in order to compare the lexical diversity across samples. All language samples had to be cut down to meet the number of words in the shortest sample. In contrast, since D calculated from random selection from a language sample, sample size produce insignificant effect on the value of D and thus allow comparison across samples with different size.

The lexical diversity measure D was obtained for each child and mother from the samples using these CLAN commands: VOCD +t\*CHI +r6 -s"@ " \*.cha and VOCD +t\*MOT +r6 -s"@ " \*.cha

Unintelligible words, fillers, interjections and retracings were not included in the calculation of D.

Since D was calculated by a random selection of tokens in each run (MacWhinney, 1995), a different value of D would be resulted from repeated running. Therefore, first run of D in each sample was used for further statistical analysis.

#### *Measure of maternal questioning style*

Questions can be defined as utterances asking for information (Blake, Macdonald, Bayrami, Agosta & Milian, 2006). Thus, strictly speaking, utterances

seeking repetition are not classified as questions, and hence were not included for analysis. Questions were divided into two types in this study. Open-ended questions included Wh-questions, such as what-, who-, when-, how- and why- questions. They seek for relatively open responses. For example, the question How did you come here? can result in responses in various ways. Some particle questions 仲有呢? and 跟住呢? were also considered open-ended questions as well because they encouraged a variety of answers. Closed-ended questions included binary, yes/no and intonation questions. For instance, the question Is it an apple? can only be answered with limited choices. All questions produced by the mothers were first classified either as open- or close-ended and the ratio of open- and close-ended questions was calculated for each mother.

#### *Maternal Education level*

While measures of maternal and child lexical diversity and questioning style were obtained from the language samples, mother's education levels were available in the background case history. Maternal education levels were classified into one of the seven categories, with 1 standing for less than primary 3, 2 for primary 4 to 6, 3 for secondary 1 to 5, 4 for secondary 6 to 7, 5 for college, 6 for university and 7 for postgraduate.

## **Results**

*Descriptive Statistics*

Table 1 shows the means and standard deviations of some basic measures obtained from the language samples. The children used 101.77 utterances on average with a range of 45 and 165, and mothers used 184.84 utterances on average with a range of 50 and 333. The children produced 313.55 words on average with a range of 72 and 563. The mothers produced 893.13 words, with a range of 210 and 1770. The variation of number of utterance and morpheme produced by children and mothers are large. This shows the language style is largely different across children and across mothers.

Table 1. Means and standard deviations of the mean number of utterances and morphemes in the mother-child samples.

<b>Variable</b>	<b>Mean</b>	<b>SD</b>	<b>Range</b>
Child			
Number of utterance	101.77	30.46	45.00 - 165.00
Number of morpheme	313.55	108.59	72.00 - 563.00
Mother			
Number of utterance	184.84	64.31	50.00 - 333.00
Number of morpheme	893.13	331.77	210.00 - 1770.00

Table 2 shows the means and standard deviations for the variables in this study.

The children produced 39.20 of D on average with a range of 17.09 and 69.29. The large range of child lexical diversity shows large individual differences in lexicon acquisition across children. The mothers produced 43.94 of D on average with a range 24.69 and 74.51. The mothers also used a ratio of open-ended question versus closed-ended question of 0.90 on average with a range of 0.27 and 2.60. Large range of maternal lexical diversity and questioning style demonstrates that maternal speech characteristics can be greatly different. On the other hand, the mean value of child lexical diversity and maternal lexical diversity are comparable. Mothers do not generally use more diverse vocabulary than children during play context. An unequal distribution of the maternal education level was observed. A majority of 62.35% of the mothers attained secondary 1 to 5 education. The disproportion was due to the compulsory education policy in Hong Kong.

Table 2. Means and standard deviations for the criterion and predictor variables.

<b>Variable</b>	<b>Mean</b>	<b>SD</b>	<b>Range</b>
Child variables			
Child lexical diversity D	39.20	11.25	17.09 - 69.29
Age of child (month)	45.33	3.75	37.00 - 52.00
Maternal variables			

Maternal lexical diversity D	43.94	10.06	24.69 - 74.51
Maternal questioning style	0.90	0.43	0.27 - 2.60
Maternal education level	3.71	1.32	1.00 - 7.00

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All statistical analyses were performed by Statistical Package for the Social Sciences (SPSS ) with significance level set at  $p = 0.01$ .

### *Correlation Analysis*

Pearson product moment correlation coefficient  $r_s$  were calculated to examine the relationship between children's lexical diversity D and each of the predictor variables. The variables include maternal lexical diversity, maternal questioning style, maternal education level and the age of child.

Table 3 shows the correlation between child lexical diversity D and each of the predictor variables (maternal lexical diversity, maternal questioning style, maternal education level and age of the child). Visual inspection of the scatterplots between child D and maternal D and between child D and maternal questioning style revealed positive linear relationship. The correlation between child lexical diversity D and maternal lexical diversity D ( $r = 0.288$ ,  $p < 0.01$ ), and the correlation between child lexical diversity D and maternal questioning style ( $r = 0.314$ ,  $p < 0.01$ ) were weak but statistically significant.

On the other hand, visual inspection of the scatterplots between child D and

maternal education level and between child D and child age revealed no discernible trend. The correlation between child lexical diversity D and maternal education level ( $r = -0.01$ ) and correlation between child lexical diversity D and age of child ( $r = 0.138$ ) were not statistically significant.

Table 3. Correlations between child lexical diversity and the predictor variables.

		Predictor variables			
		Maternal lexical diversity D	Maternal questioning style	Maternal education level	Age of child
Child lexical diversity D		0.288**	0.314**	- 0.01	0.138

\*\*  $p < 0.01$

Table 4 shows the correlation between the predictor variables (maternal lexical diversity, maternal questioning style, maternal education level and age of the child). Visual inspection of the scatterplots between maternal D and maternal questioning style revealed negative linear relationship. The correlation between the two variables ( $r = 0.276$ ,  $p < 0.05$ ) was weak and only statistically significant at the  $p < 0.05$  level.

No linear trend was revealed for the correlation of other predictor variables. The correlations between these predictor variables were not statistically significant.



Table 4. Correlations between the predictor variables.

	Predictor variables			
	Maternal lexical diversity D	Maternal questioning style	Maternal education level	Age of child
Maternal lexical diversity		- 0.276*	0.104	0.151
Maternal questioning style	- 0.276*		0.054	0.026
Maternal education level	0.104	0.054		0.032
Age of child	0.151	0.026	0.032	

\*  $p < 0.05$

#### *Multiple Regression Analysis*

A stepwise multiple regression analysis was run to examine the set of variables that could predict the child lexical diversity D and to report on the percentage of variance in child lexical diversity they could account for.

Table 5 shows the summary of the multiple regression analysis. Two of the predictor variables, maternal education level and age of child, were dropped because their correlation with the criterion variable child lexical diversity D were not significant (Grimm & Yarnold, 1995). Thus, they did not provide statistically significant contributions to the prediction of child lexical diversity D. The resulting

equation involved maternal lexical diversity D and maternal questioning style. When the maternal questioning style was entered, the  $R^2$  of 0.088 indicated only 8.8% of the child lexical diversity D could be predicted from the maternal questioning. 91.2% of the variance of lexical diversity D was not predictable from the maternal questioning style. When the second predictor variable, maternal lexical diversity D, was entered, the predicting power of this set of variables increased significantly by 0.144  $R^2$ . As a result, this set of predictor variables could together predict 23.2% of the variances in child lexical diversity.

Table 5. Summary statistics for the multiple regression analysis of maternal variables predicting the child lexical D

Variable	R	$R^2$	Change in $R^2$	p
Maternal questioning style	0.314	0.088	---	0.003
Maternal lexical diversity D	0.500	0.232	0.144	0.000

## Discussion

This study was designed to investigate relationships between maternal variables and the child lexical diversity in three-year-old Cantonese-speaking children. These relationships will be discussed in turn.

*Relationship of maternal lexical diversity and child lexical diversity*

This study documented a weak but significant correlation between maternal lexical diversity and child lexical diversity. This finding added support to earlier reports on such a relationship in English-speaking children. Under the cultural difference, the maternal and child lexical diversity are still correlated. Thus, a mother who uses more diverse vocabulary in her speech is likely to have a child with high lexical diversity, and vice versa. One of the possible reasons is that these children are able to utilize their mothers' language input in their own lexicon learning. On the other hand, input in other contexts may not be able to do the same work as mothers' language input. Christakis, Zimmerman, DiGiuseppe, and McCarty's study (2004) reanalyzed data collected for a national longitudinal study completed in the US during the 1980s and reported that children aged 3 1/2 years watched television 3.6 hours a day. It showed that children at the time received a large amount of language input from various television programs. In Grela, Lin, and Krcmar's study (as cited in Anderson & Pemp, 2005), 2 1/2-year-old children's learning of object labels was examined under live conditions and via television or video-watching. Children were able to learn vocabulary from watching television, however, they learned less from television than from real-life experiences. One possible reason is that not all television programs are produced for children and they may pay little overt attention to new words in these programs. These findings suggest that it is not just any diverse

vocabulary, but diverse vocabulary provided during interactive communicative activities like the one mother and child engaged in that facilitate vocabulary growth in the children. In these activities, mothers and children are likely to talk about the here-and-now context, in which children are likely to engage in joint attention, a precursor to learning. In addition, mothers' speech is clear, well formed, semantically and syntactically simpler than speech addressed to adults (Gallaway & Richards, 1994) so they are more comprehensible for children. Hence, children are able to learn more from mothers' input and it is one of the possible explanations for the significant correlation between maternal lexical and child lexical diversity.

*Relationship of maternal questioning style and child lexical diversity*

Result of this study indicated that the ratio of open-ended to close-ended questions in mothers' utterances correlated in a mild degree with the children's lexical diversity. In other words, for a mother who uses a higher ratio of open-ended questions versus close-ended questions, the child is more likely to use more diverse vocabulary. When a child acquires a word, s/he is learning all the properties of the object or action, or attribute the word refers to. If a mothers use an open-ended question to introduce a word, for example, how does it operate?, the child is invited to take an active role to explore its meanings. And the mother is able to follow up on the child's answer and asks other questions for further elaboration of the meaning of the

word. Thus, asking open-ended questions is likely to facilitate the mapping of various meanings to the new word.

Building on findings from previous studies, the results of this study added to the literature, and provided further evidence that documented a correlation of the use of open-ended questions and child lexical diversity. In fact, this study further revealed that the correlation between questioning style and child lexical diversity had no gender effect, since the same correlational relationship reported for fathers in Rowe et al. (2004), was reported in mothers in this study. Under the possible cultural difference in the belief of using open-ended questions versus close-ended questions in child directed talk (Johnston & Wong, 2002), the correlation of questioning style and child's lexical diversity was still true for Cantonese-speaking children.

#### *Maternal variables predicting child lexical diversity*

The maternal lexical diversity and questioning style together predict 23.2% of the variance in three-year-old children's lexical diversity. Maternal variables which were not under investigation in this study, such as maternal age, emotional state, amount of talk addressed to child (Rowe et al., 2005) are other possible maternal variables for predicting the lexical diversity of Cantonese speaking children. Further research may be done on these variables to reveal the full picture of how maternal variables correlate with lexicon diversity in Cantonese-speaking children.

*Relationship of maternal education and child lexical diversity*

Despite the fact that a positive correlation between the maternal education level and child lexical diversity has been reported in English-speaking children, no significant correlation was found between the two variables on the Cantonese participants in this study. It may be due to the following reasons. The language samples used in this study were collected on a random sample of children in Hong Kong. Their mothers education distribution levels were reflective of the distribution in the entire women population in Hong Kong (Census and Statistic Department, 2006). Most of the mothers were at the secondary education level given that children are entitled to nine years of free but compulsory education (primary one to secondary three) since 1978. Given that the language samples and case history information were not collected specifically for purposes of this study, we were not able to manipulate the maternal education variable and include mothers from more different education backgrounds for examination of its relationship with children's lexical diversity, unlike the previous studies (Dollaghan et al., 1999; Rowe et al., 2005). In Dollaghan et al.'s (1999) study, children participants were divided into three groups according to maternal education. Significant group differences were found on children's lexical diversity as measured by number of different words (NDW). A trend analysis also revealed a linear trend for the three maternal education groups showing a correlation

between maternal education and children lexical diversity. In the current study, a majority of 62.35% of the maternal education level fell into the group of secondary 1 to 5. The limited range of maternal education significantly reduces the magnitude of correlation (Oller, 2006). Therefore the insignificant correlation found in the current study was not reliable and conclusive.

#### *Relationship of child age and child lexical diversity*

Previous studies documented developmental trend of lexical diversity. Duran, Malvern, Richards & Chipere's study (2004) reported significant developmental trend in two hundred and twelve English-speaking children of age 18 to 42 months. Klee et al.' study (2004) also found significant curvilinear relationship between child age and lexical diversity in seventy-four Cantonese-speaking children of age 27 to 68 months. However, negative result was reported in the current study. No significant correlation was found between age and child lexical diversity. It may be because the range of age (37 to 52 months of age) in this study was limited. The magnitude of correlation was reduced by the limited age range (Oller, 2006).

#### *Limitations of this study and direction for further research*

Spontaneous language sample was a valuable source for investigating the language behaviour, for example, lexical diversity and questioning style, of both communication partners (Leadholm & Miller, 1995). However, the language samples

are only useful when they meet certain quality. The current study was limited by the quality of some of the language samples. In some of the language samples, natural interaction between the mother and child were affected by the presence of the investigator. Some of the investigators took an active role in the conversation and they engaged in many conversation turns. Some of the mothers also asked their children to address his/her speech to the investigator, for example, “Tell the investigator what it is (話俾姐姐聽呢個咩尼嘅.)”. Also, some mothers in the language sample tended to ask a high number of questions. Mothers produced 184 utterances on average, and a mean of 89 questions were produced. Over 60% of the utterances were questions for 20% of the mothers in this set of language sample. This behaviour may be resulted from the awareness that they were being involved in a research study. Hence, in the future study, investigators should be particularly trained to avoid interference to the natural interaction between the communication partners and to give clear instructions to allow communication partner to interact as the way they did their daily conversation.

### **Clinical Implication**

In this study, maternal lexical diversity and questioning style were found to be significant predictors predicting child lexical diversity. Information could be provided to the parents of children with typical language development. Using more



diverse vocabulary and asking more open-ended question versus close-ended question may facilitate the child lexical development. However, this may not be applicable to children with atypical language development because they respond to open-ended questions with a different fashion (Deevy & Leonard, 2004). They have significant difficulties in comprehending long object wh-questions. Open-ended questions presenting linguistic and communication challenge to the children with language impairment (Rowe et al., 2005), which may discourage their language production.

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