

# The Influence of Children's Temperament, Phonological Working Memory, Mother Related Factors, and Language Environment on Vocabulary Development in Korean Monolingual and English-Korean Bilingual Children

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Received: January 4, 2022  
Revised: May 7, 2022  
Accepted: May 17, 2022

This work was supported by the Ministry of Education of the Republic of Korea and the National Research Foundation of Korea (NRF-2021S1A3A2A01096102).

**Objectives:** This study investigated the influence of internal and external factors on vocabulary development in Korean monolingual and English-Korean bilingual children, and examined predictors of their vocabulary skills. **Methods:** A total of 45 children aged from 3-6 years participated in this study, including Korean monolingual children (N=30), and English-Korean bilingual children (N=15). Children completed standardized vocabulary tests to measure vocabulary skills. To examine internal and external factors, a nonword repetition (NWR) task was administered, and participants' mothers completed the Children's Behavior Questionnaire-Very Short Form, the Parenting Stress Index, Fourth Edition Short Form (PSI-4-SF), the Parental Styles and Dimensions Questionnaire, and the Language Environment Questionnaire. **Results:** For monolingual children, internal factors were significantly correlated with Korean vocabulary skills, and effortful control was the only predictor. For bilingual children, there was a significant correlation between internal factors and Korean vocabulary skills. Effortful control and Korean NWR were predictors of Korean receptive vocabulary skills, and Korean NWR predicted Korean expressive vocabulary skills. Their English vocabulary skills were significantly associated with internal and external factors. Quantity of mother's English input and English NWR were predictors of English receptive vocabulary skills, and quantity of mother's English input, English NWR and quality of Korean input were predictors of English expressive vocabulary skills. **Conclusion:** The results suggest that when examining vocabulary skills, we should consider the influence of effortful control for monolingual children and the influence of mothers' language use at home for bilingual children. Furthermore, NWR should be applied as a clinical tool when assessing bilingual children.

**Keywords:** Temperament, Phonological working memory, Mother related factors, Language environment, Vocabulary development, Bilingual children

Vocabulary skills are essential for overall language development and contribute to specific language domains such as phonological awareness (De Jong, Seveke, & van Veen, 2000), narrative ability (Uccelli & Páez, 2007), and reading comprehension (Proctor, Uccelli, Dalton, & Snow, 2009). These skills can also influence chil-

dren's academic achievement (Pham & Tipton, 2018). Thus, vocabulary skills play an important role in children's development, highlighting the need to investigate factors affecting vocabulary development. Factors that support children's vocabulary skills are classified as either internal or external. Internal factors include bi-

ological and cognitive characteristics, whereas external factors are environmental and include socioeconomic status and language input and quality (Sun, Yin, Amsah, & O'Brien, 2018). Studies have shown that both internal and external factors affect children's vocabulary development (Paradis, 2011; Pham & Tipton, 2018; Sun et al., 2018).

Temperament has been identified as one of the prominent internal factors affecting children's vocabulary development. Because it determines children's behaviors and explains individual differences in development, it is crucial to consider temperament in the early developmental period (Lim & Bae, 2015). Scholars often differ in their perspectives on temperament. The most traditional view is that temperament consists of an individual's unique features that cannot be altered by their environment (Allport, 1937; Buss & Plomin, 1984). According to this perspective, temperament emerges clearly in infancy when the environment exerts less influence. Hence, there have been many studies investigating the correlation between temperament measured in infancy and vocabulary, with several concluding that a significant relationship does exist (Dixon & Smith, 2000; Karrass & Braungart-Rieker, 2003; Shin, 2015).

As researchers have acknowledged the influence of the environment on temperament, they have highlighted temperament's constitutional approach (Rothbart & Bates, 2006), which is defined as the biological bases of temperament, affected by heredity, maturation, and experience over time. From this perspective, it is important to examine the correlation between temperament measured after infancy and vocabulary. Noel, Peterson, and Jesso (2008) studied children between ages 2;8 and 4;10, observing that the temperamental dimension of emotionality—indicating the degree to which a child behaves emotionally—was negatively correlated with receptive vocabulary skills. Palermo, Mikulski, and Conejo (2017) studied Spanish-English bilingual children between ages 3;7 and 5;0. They reported that effortful control—which includes emotion regulation, inhibitory control, shifting attention, and focusing—increased the probability of being involved in high-balanced Spanish-English bilingual children which referred to children who scored high in both Spanish and English receptive and expressive vocabulary skills.

Phonological working memory, which stores the phonological form of a word temporarily, is one internal factor that is usually

measured with a nonword repetition (NWR) task. Phonological working memory is a critical ability that helps children acquire new words (Baddeley, Gathercole, & Papagno, 1998). Many studies have revealed the relationship between phonological working memory and vocabulary skills in both monolingual children (Gathercole & Baddeley, 1989; Gathercole, Hitch, & Martin, 1997; Gathercole, Willis, Emslie, & Baddeley, 1992; Jung & Ha, 2017; Yang & Yim, 2018; Yang, Yim, Kim, & Han, 2013) and bilingual children (Paradis, 2011; Pham & Tipton, 2018; Yim, Jo, Han, & Seong, 2016). Yang and Yim (2018) reported a significant correlation between accuracy on the NWR and receptive vocabulary skills in five to six-year-old monolingual children. Gathercole and colleagues (1992) also found a significant correlation between phonological working memory as measured by NWR and receptive vocabulary skills in four-, five-, and six-year-old monolingual children. Even when controlling for age and nonverbal intelligence, the relationship between phonological working memory and vocabulary skills remained statistically significant. To determine the contribution of phonological working memory to vocabulary skills in bilingual children, Paradis (2011) studied four- to seven-year-old bilingual children in newcomer families living in Canada. The researcher reported that phonological working memory was the strongest predictor of English (i.e., their second language) receptive vocabulary skills. Similarly, Pham and Tipton (2018) studied five- to eight-year-old bilingual children whose first language (L1) was Vietnamese, and second language (L2) was English. They discovered significant correlations both between Vietnamese NWR and Vietnamese receptive vocabulary and between English NWR and English receptive vocabulary. Moreover, they found that both Vietnamese and English NWR were significantly correlated with English expressive vocabulary. Thus, phonological working memory is a noteworthy internal factor that positively influences both monolingual and bilingual children's vocabulary skills.

When examining the context of children's development, considering family—specifically, a child's parental family—is highly important (Collins, Maccoby, Steinberg, Hetherington, & Bornstein, 2000; Darling & Steinberg, 1993). One noteworthy factor is parenting stress, which Abidin (1995) defined as the discrepancy between the demands of the parenting role and the perceived resources available for meeting those demands. Parents' character-

istics, children's characteristics, and the interactive environment of parents and children all affect parenting stress (Misri et al., 2010). Because of this stress, it is common for parents to become exhausted from the burdens imposed by their parental roles (Abidin, 1990). Studies have reported an inverse relationship between parenting stress and vocabulary development in preschoolers (Harmeyer, Ispa, Palermo, & Carlo, 2016; Noel et al., 2008). Noel and colleagues (2008) discovered significant negative correlations between parenting stress and the receptive and expressive vocabulary skills of children between ages of 2;8 and 4;10. Likewise, Harmeyer and colleagues (2016) reported longitudinal effects of maternal parenting stress on children's vocabulary development, finding a negative association between mothers' parenting stress measured when children were fifteen-month-olds and children's receptive vocabulary skills measured at kindergarten entry.

Another parental factor influencing children's vocabulary development is parenting style. Parenting style is defined as parents' attitudes and behaviors expressed toward their children during parenting (Darling & Steinberg, 1993). Belsky (1984) suggested the "process model," which classifies parenting style based on the parents' marital relationship, social support, characteristics, and jobs. According to Belsky, these factors all affect children's development. Moreover, parenting styles influence children's personality and their adaptability or lack thereof (Johnson, 2006). Previous studies have identified both a direct and an indirect relationship between maternal parenting style and children's vocabulary skills (Bingham, Jeon, Kwon, & Lim, 2017; Kim, 2016; Kim & Shin, 2015; Pae, Kwak, Kim, Jung, & Kim, 2009). Kim and Shin (2015) investigated the association between maternal parenting style and vocabulary skills in ten- to twenty-four-month-olds. The researchers measured parenting style using the Parental Style Questionnaire (PSQ; Bornstein et al., 1996), which is divided into three dimensions: social exchange, didactic interactions, and limit-setting. They found positive correlations between all dimensions of parenting style and children's receptive and expressive vocabulary skills. Bingham and colleagues (2017) found that the quality of the home literacy environment mediated the positive relationship between ethnically diverse mothers' authoritative parenting style and their preschool-age children's oral language abilities (vocabulary and phonological awareness).

The social interactionist theory (Vygotsky, 1978) emphasizes the role of children's environment and parent-child interactions when assessing children's language development. Children's language environment is determined by the quantity and quality of their interactions (Wong, 2001). Bilingual children's vocabulary skills in each language are directly related to their parents' language quantity, with use measured for both languages (De Houwer, 2007; Hoff et al., 2012; Pham & Tipton, 2018), and language quality, which is measured as the frequency of language-enrichment activities (Pham & Tipton, 2018; Scheele, Leseman, & Mayo, 2010). In particular, many studies have highlighted the importance of mothers' L1 use with their children, as it has a strong positive effect on children's language development (Hoff, Core, & Shanks, 2020; Pham & Tipton, 2018; Yim, Baek, Kim, & Han, 2020). Tsai, Park, Liu, and Lau (2012) studied four- to seven-year-old Chinese-English bilingual children and found that mothers' L1 (Chinese) use was positively correlated with children's Chinese receptive and expressive vocabulary skills. Likewise, Pham and Tipton (2018) reported that Vietnamese vocabulary skills of Vietnamese-English bilingual children between ages five and eight were significantly associated with parents' Vietnamese use and the frequency of Vietnamese activities at home. These results indicate strong correlations between the quantity and quality of language use and children's vocabulary development. In summary, language development changes depending on the language environment at home (Hoff, 2006). This suggests that the language environment is an important influence on children's vocabulary development.

In Korean society, children from multilingual families comprise the largest proportion of bilingual children. A multicultural family is a family unit in which various cultures coexist and can include international marriage, foreign workers, and refugees (Song, Lea, & Shin, 2009). Kohnert (2013) defined bilingual children as those who need two languages, regardless of proficiency in both languages. From this perspective, if children in multicultural families need two languages, then they are considered bilingual children. According to the 2018 National Multicultural Family Survey in Korea, the number of multicultural families including children living in Korea has increased rapidly over the past 10 years (Ministry of the Interior and Safety, 2019). Hence, there have been many studies investigating the relationship between various factors and

children's language development in different families with mothers from Vietnam, Cambodia, China, and Taiwan. Although challenges faced by mothers from multicultural families would emerge regardless of nationality, studies examining the relationship between children's language development and mother related factors in multicultural families from English-speaking countries are less common. Moreover, since most children's main caregiver is the mother, this study aimed to investigate the influence of mothers to children. Thus, the purpose of this study was to investigate factors influencing vocabulary development in Korean monolingual and English-Korean bilingual children (whose mothers' L1 was English and fathers' L1 was Korean) and to examine predictors of these children's vocabulary skills. Research questions are as follows:

1. For Korean monolingual children, are there significant correlations among internal factors (temperament, phonological working memory), external factors (parenting stress, parenting style, quantity of mothers' Korean input, quality of Korean input), and Korean vocabulary skills?
2. For English-Korean bilingual children, are there significant correlations among internal factors (temperament, phonological working memory), external factors (parenting stress, parenting style, quantity of mothers' English and Korean input, quality of English and Korean input), and Korean and English vocabulary skills?
3. Which of these factors—temperament, phonological working memory, parenting stress, parenting style, quantity of mothers' Korean input, and quality of Korean input—significantly predict Korean monolingual children's Korean vocabulary skills?
4. Which of these factors—temperament, phonological working memory, parenting stress, parenting style, quantity of mothers' English and Korean input, quality of English and Korean input—significantly predict English-Korean bilingual children's Korean and English vocabulary skills?

## METHODS

### Participants

A total of 45 children aged from 3-6 years who lived in Seoul, the suburbs of Seoul, or Busan participated in this study. Among

the participants, there were 30 Korean monolingual children (aged from 3;2-6;7) and 15 English-Korean bilingual children (aged from 3;2-6;5). All children attended Korean educational institutions and were enrolled in a program using mostly or exclusively Korean with supplemental English classes.

### Korean monolingual children

The 30 Korean monolingual children who participated in this study met the following criteria: (1) both parents' L1 is Korean; (2) Korean is used at home and in school; (3) use English less than two hours per day; (4) nonverbal intelligence standard score is above 85 on the Korean-Kaufman Assessment Battery for Children (K-ABC; Moon & Byun, 2003); and (5) no physical, sensory, or neurological impairment.

### English-Korean bilingual children

The 15 English-Korean bilingual children who participated in this study met the following criteria: (1) mother's L1 is English; (2) father's L1 is Korean; (3) exposed to English and Korean by their parents; (4) nonverbal intelligence standard score is above 85 on the Korean-Kaufman Assessment Battery for Children (K-ABC; Moon & Byun, 2003); and (5) no physical, sensory, or neurological impairment.

The mean age of Korean monolingual children was 55.27 months (SD = 12.34) and English-Korean bilingual children's mean age was 56.67 months (SD = 12.13). The average standard score of nonverbal intelligence of Korean monolingual children was 111.93 (SD = 8.67) and the score of English-Korean bilingual children was 112.00 (SD = 9.17). The mean years of Korean monolingual children's maternal education was 15.93 (SD = 1.11), which indicates they mostly had university degree. The mean years of English-Korean bilingual children's maternal education was 17.07 (SD = 1.03), which indicates they mostly had university degree or master's degree. Table 1 presents the means and standard deviations of participants' chronological age, nonverbal intelligence, and mothers' years of education.

### Measures

#### Standardized measures

We administered the Korean Kaufman Assessment Battery for

**Table 1.** Participants' characteristics

	MO (N=30)	BI (N=15)
Age (mo)	55.27 (12.34)	56.67 (12.13)
Nonverbal intelligence <sup>a</sup>	111.93 (8.67)	112.00 (9.17)
Mother's education (year) <sup>b</sup>	15.93 (1.11)	17.07 (1.03)

Values are presented as mean (SD).

MO = Korean monolingual children; BI = English-Korean bilingual children.

<sup>a</sup>Korean-Kaufman Assessment Battery for Children (K-ABC; Moon & Byun, 2003),

<sup>b</sup>Language Environment Questionnaire (Yim et al., 2020; Paradis, 2011).

Children (K-ABC; Moon & Byun, 2003) to measure participants' nonverbal intelligence. To measure monolingual and bilingual children's Korean receptive and expressive vocabulary, we utilized the Receptive and Expressive Vocabulary Test (REVT; Kim, Hong, Kim, Jang, & Lee, 2009). Additionally, we used the Peabody Picture Vocabulary Test-IV (PPVT-IV; Dunn & Dunn, 2007) to measure bilingual children's English receptive vocabulary and the Expressive One Word Vocabulary Test-4 (EOWPVT-4; Martin & Brownell, 2011) to measure bilingual children's English expressive vocabulary.

Phonological working memory: Nonword repetition (NWR)

To investigate children's phonological working memory, we administered the Korean NWR task (Yim & Han, 2019) to monolingual children and both the Korean and English NWR (Yim et al., 2016) tasks to bilingual children. Children listened to nonwords from a recording and attempted to repeat exactly what they had heard. The Korean NWR task includes 15 nonwords, with three nonwords each of two, three, four, five, and six syllables. The English NWR task includes 16 nonwords, with four nonwords each of one, two, three, and four syllables. Table 2 displays examples of nonwords in the English NWR.

Temperament: The Children's Behavior Questionnaire-Very Short Form

To measure children's temperament, bilingual children's mothers completed the Children's Behavior Questionnaire-Very Short Form (CBQ-VSF; Putnam & Rothbart, 2006), and monolingual children's mothers completed the Korean-translated version (Lim & Bae, 2015). They read each statement and checked the response option that best described their child's reactions within the past six months. The questionnaire includes 36 items divided along

**Table 2.** Examples of nonwords in the English NWR

Syllable	Example
1	naib
2	tei vak
3	tsi noi taub
4	dae vou noi tsig

three dimensions: (1) surgency (12 items), defined as high levels of activity, high-intensity pleasure, and low levels of shyness; (2) negative affectivity (12 items), characterized by discomfort, fear, anger, frustration, sadness, and difficulty in becoming calm; and (3) effortful control (12 items), defined as inhibitory control, attentional focusing, perceptual sensitivity, and low-intensity pleasure (Rothbart & Bates, 2006). Each item utilized a 7-point Likert scale ranging from 1 (*extremely untrue of your child*) to 7 (*extremely true of your child*). If a mother could not respond to an item because she had never seen her child in that situation, she circled "NA" (i.e., not applicable).

Parenting stress: Parenting Stress Index, Fourth Edition Short Form

To measure parenting stress, bilingual children's mothers completed the Parenting Stress Index, Fourth Edition Short Form (PSI-4-SF; Abidin, 2012), and monolingual children's mothers answered its Korean version (K-PSI-4-SF; Chung, Yang, Jung, Lee, & Park, 2019). They read each statement and checked the response option that best described their feelings or thoughts about their child. The questionnaire includes 36 items divided along three dimensions: (1) parental distress (12 items), which is the level of stress experienced in parenting; (2) parent-child dysfunctional interaction (12 items), which is the degree to which parents feel that their children are meeting their expectations, and stability of parent-child interaction; and (3) difficult child (12 items), which is parents' perceptions of their children's temperament or behavioral characteristics (Abidin, 2012). The combined dimensions represent total parental stress. Each item utilized a 5-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*).

Parenting style: Parenting Styles and Dimensions Questionnaire

To investigate parenting style, bilingual children's mothers com-

pleted the Parenting Styles and Dimensions Questionnaire (PSDQ; Robinson, Mandlco, Olsen, & Hart, 1995), and monolingual children's mothers completed the Korean-translated version (Korea Institute of Child Care and Education, 2018). They read each statement and checked the response option that best described how often they exhibited those behaviors with their child. The questionnaire includes 62 items divided along three dimensions: (1) authoritative parenting (27 items), which is setting clear standards for children's behaviors without being too restrictive or intrusive (Ishak, Low, & Lau, 2012), using physical and verbal expressions to show support for children, and caring for children with close relationships; (2) authoritarian parenting (20 items), which is controlling children's behaviors with rigid rules and punishing unwanted behaviors; and (3) permissive parenting (15 items), which is being lenient with children so as to approve all their behaviors and exercising minimal discipline (Önder & Gülay, 2009). Each item utilized a 5-point Likert scale ranging from 1 (*never*) to 5 (*always*).

#### Language environment: Language Environment Questionnaire

To examine language environment, we selected and revised items from the Parental Language Environment Questionnaire (PLEQ; Yim, Kim, Han, Kang, & Lee, 2020) and the Alberta Language Environment Questionnaire (ALEQ; Paradis, 2011). Certified speech language pathologists with more than 5 years of clinical and research experience in monolingual and bilingual children evaluated our new scale's validity. The validity of mother's language quantity was 93.8%, and the validity of mother's language quality was 93.5%. Moreover, the wording of some questions was clarified based on their feedbacks. To assess the quantity of mothers' English and Korean input, mothers checked the language that they used in each activity (e.g., dressing, eating breakfast, bedtime activities) and the total amount of time (in 5-minute intervals) using the language in each activity, which ranged from less than 5 minutes to more than 30 minutes. For responses of "less than 5 minutes" or "more than 30 minutes," mothers were required to write in the actual time. To assess the quality of English and Korean input, mothers checked the number of days per week that their children engaged in language-based (English and Korean) enrichment activities (e.g., reading books, role playing). Finally, the question-

naire included several demographic items addressing parents' nationality, native language, and mother's years of education.

#### Procedure

This study was approved by the Institutional Review Board (ewha-202009-0022-01) of Ewha Womans University. Before the test began, the examiner obtained informed consent from all participants including children and their parents.

The examiner conducted all tests with the children in a quiet environment. Monolingual children completed the K-ABC (Moon & Byun, 2003), the REVT (Kim et al., 2009), and the Korean NWR task (Yim & Han, 2019). In addition to these tests, bilingual children completed the PPVT-IV (Dunn & Dunn, 2007), the EOW-PVT-4 (Martin & Brownell, 2011), and the English NWR task (Yim et al., 2016).

While the examiner was conducting these tests with the children, their mothers completed four questionnaires: the CBQ-VSF (Lim & Bae, 2015; Putnam & Rothbart, 2006), the PSI-4-SF (Abidin, 2012) or K-PSI-4-SF (Chung et al., 2019), the PSDQ (Korea Institute of Child Care and Education, 2018; Robinson et al., 1995), and our new language environment scale, Language Environment Questionnaire (Paradis, 2011; Yim, Kim, et al., 2020). The examiner explained the directions for each questionnaire in detail and answered all participants' questions about the procedure. Monolingual children's mothers completed questionnaires written in Korean, and bilingual children's mothers completed questionnaires written in English. If bilingual children's mothers preferred to use English, then the examiner communicated with them in English.

#### Scoring

##### Standardized vocabulary measures

We calculated raw scores for monolingual children's Korean vocabulary skills. If a vocabulary test is administered to bilingual children in only one language, it can underestimate their vocabulary skills (Bedore, Peña, Garcia, & Cortez, 2005). Thus, to reduce the likelihood of misdiagnosing participants' vocabulary skills, we applied conceptual scoring with bilingual children to check whether the children knew the concepts of the vocabulary words (Bedore et al., 2005; Kohnert, Hernandez, & Bates, 1998; Pearson,

Fernandez, & Oller, 1993).

Phonological working memory: Nonword repetition (NWR)

For Korean NWR, we scored each syllable for accuracy (1 = correct, 0 = incorrect) in relation to its target syllable. For English NWR, we scored each consonant for accuracy (1 = correct, 0 = incorrect). For each task, we calculated a total score and used it as a metric for phonological working memory in Korean and English, respectively.

Temperament: The Children's Behavior Questionnaire

Responses were measured with the 7-point Likert scale. Items 13, 19, 20, 22, 26, 29, 31, and 34 were reverse-scored. Then, we converted the score for each dimension into a percentage for ease of comparison.

Parenting stress: Parenting Stress Index, Fourth Edition Short Form

Responses were measured with the 5-point Likert scale. Item 32 was reverse-scored on the PSI-4-SF (Abidin, 2012), and items 22 and 33 were reverse-scored on the K-PSI-4-SF (Chung et al., 2019). We summed the scores of all dimensions to calculate total parenting stress, which we then converted into a percentage.

Parenting style: Parenting Styles and Dimensions Questionnaire

Responses were measured with the 5-point Likert scale. Items 24, 38, and 52 were reverse-scored. Then, we converted the score for each dimension into a percentage for ease of comparison.

Language environment: Language Environment Questionnaire

To measure the quantity of mothers' English and Korean input, for each language we summed the amounts of time mothers used language in each activity. To examine quality of English and Korean input, for each language we summed the frequency (none = 0, 1 day = 1, 2 days = 2, 3 days = 3, 4 days = 4, 5 days = 5, 6 days = 6, every day = 7) of language-related activities.

### Statistical Analysis

To investigate relationships among internal factors, external factors, and vocabulary skills in each group of children, we computed Pearson correlation coefficients. Further, we utilized stepwise multiple regression to examine factors predicting each group's vocabulary skills. We conducted all statistical analyses using IBM SPSS Statistics 25.

**Table 3.** Correlations among internal factors, external factors, and vocabulary skills in Korean monolingual children

	REVT-R <sup>a</sup>	REVT-E <sup>a</sup>	NWR_KOR <sup>b</sup>	TEM_SUR <sup>c</sup>	TEM_NA <sup>c</sup>	TEM_EC <sup>c</sup>	PAR_au- thoritative <sup>d</sup>	PAR_au- thoritarian <sup>d</sup>	PAR_per- missive <sup>d</sup>	Stress <sup>e</sup>	KOR_ quantity <sup>f</sup>
REVT-E <sup>a</sup>	.841**										
NWR_KOR <sup>b</sup>	.319	.528**									
TEM_SUR <sup>c</sup>	-.356	-.379*	-.408*								
TEM_NA <sup>c</sup>	.173	.118	-.121	-.227							
TEM_EC <sup>c</sup>	.566**	.676**	.575**	-.241	-.194						
PAR_au- thoritative <sup>d</sup>	.125	.171	.413*	-.036	-.195	.528**					
PAR_au- thoritarian <sup>d</sup>	-.054	-.106	-.490**	-.050	.531**	-.344	-.493**				
PAR_per- missive <sup>d</sup>	-.010	.035	-.230	-.127	.261	-.170	-.512**	.358			
Stress <sup>e</sup>	-.136	-.064	-.298	-.076	.374*	-.333	-.622**	.570**	.640**		
KOR_Quantity <sup>f</sup>	-.011	-.060	-.100	.263	.167	.187	.154	.131	-.041	.113	
KOR_quality <sup>f</sup>	-.286	-.028	-.152	.389*	.031	-.038	.035	-.051	.160	.209	.092

REVT-R=Korean receptive vocabulary; REVT-E=Korean expressive vocabulary; NWR\_KOR=Korean nonword repetition; TEM\_SUR=temperament-surgency; TEM\_NA=temperament-negative affectivity; TEM\_EC=temperament-effortful control; PAR=parenting style; Stress=total parenting stress; KOR\_quantity=total time of mothers' Korean use; KOR\_quality=total frequency of Korean activities.

<sup>a</sup>Receptive and Expressive Vocabulary Test-Receptive (Kim et al., 2009), <sup>b</sup>Korean NWR task (Yim & Han, 2019), <sup>c</sup>Korean-translated version of Children's Behavior Questionnaire-Very Short Form (Lim & Bae, 2015), <sup>d</sup>Korean-translated version of Parenting Styles and Dimensions Questionnaire (Korea Institute of Child Care and Education, 2018), <sup>e</sup>Korean Parenting Stress Index, Fourth Edition Short Form (K-PSI-4-SF; Chung et al., 2019), <sup>f</sup>Language Environment Questionnaire (Yim et al., 2020; Paradis, 2011).

\* $p < .05$ , \*\* $p < .01$ .

## RESULTS

### Correlational Analysis: Korean Monolingual Children

Table 3 displays the results of the correlational analysis for the Korean monolingual children group. First, Korean receptive vocabulary skills were positively correlated with effortful control ( $r = .566, p = .001$ ). Additionally, Korean expressive vocabulary skills were positively correlated with Korean NWR ( $r = .528, p = .003$ ) and effortful control ( $r = .676, p < .001$ ) but were negatively correlated with surgency ( $r = -.379, p = .039$ ).

Among the internal and external factors, Korean phonological working memory was positively correlated with effortful control ( $r = .575, p = .001$ ) and authoritative parenting style ( $r = .413, p = .023$ ) but was negatively correlated with surgency ( $r = -.408, p = .025$ ) and authoritarian parenting style ( $r = -.490, p = .006$ ). Surgency was positively associated with quality of Korean input ( $r = .389, p = .034$ ). Negative affectivity was positively associated with au-

thoritarian parenting style ( $r = .531, p = .003$ ) and parenting stress ( $r = .374, p = .042$ ). Effortful control was positively associated with authoritative parenting style ( $r = .528, p = .003$ ). Authoritative parenting style was negatively correlated with authoritarian ( $r = -.493, p = .006$ ) and permissive ( $r = -.512, p = .004$ ) parenting styles. Parenting stress was positively associated with authoritarian ( $r = .570, p = .001$ ) and permissive ( $r = .640, p < .001$ ) parenting styles but was negatively associated with authoritative parenting style ( $r = -.622, p < .001$ ).

### Correlational Analysis: English–Korean Bilingual Children

Table 4 displays the results of the correlational analysis for the English-Korean bilingual children group. Korean receptive vocabulary skills were positively correlated with Korean NWR ( $r = .631, p = .012$ ), English NWR ( $r = .676, p = .006$ ), and effortful control ( $r = .705, p = .003$ ). Korean expressive vocabulary skills were posi-

**Table 4.** Correlations among internal factors, external factors, and vocabulary skills in English-Korean bilingual children

	REVT-R <sup>a</sup>	REVT-E <sup>a</sup>	PPVT <sup>b</sup>	EOW-PVT <sup>c</sup>	NWR_KOR <sup>d</sup>	NWR_ENG <sup>e</sup>	TEM_SUR <sup>f</sup>	TEM_NA <sup>f</sup>	TEM_EC <sup>f</sup>	PAR_authoritative <sup>g</sup>	PAR_authoritarian <sup>g</sup>	PAR_permissive <sup>g</sup>	Stress <sup>h</sup>	ENG_quantity <sup>i</sup>	KOR_quantity <sup>j</sup>	ENG_quality <sup>j</sup>
REVT-E <sup>a</sup>	<b>.662**</b>															
PPVT <sup>b</sup>	.477	.389														
EOWPVT <sup>c</sup>	.257	.215	<b>.900**</b>													
NWR_KOR <sup>d</sup>	<b>.631*</b>	<b>.789**</b>	.328	.189												
NWR_ENG <sup>e</sup>	<b>.676**</b>	<b>.640*</b>	<b>.629*</b>	<b>.625*</b>	<b>.658**</b>											
TEM_SUR <sup>f</sup>	-.158	-.294	<b>-.651**</b>	<b>-.650**</b>	-.224	-.299										
TEM_NA <sup>f</sup>	.051	-.054	.000	-.057	-.170	-.275	.062									
TEM_EC <sup>f</sup>	<b>.705**</b>	.422	.487	.173	.294	.429	-.302	.224								
PAR_authoritative <sup>g</sup>	.233	.432	-.004	-.231	.260	.004	-.026	.512	.497							
PAR_authoritarian <sup>g</sup>	.164	-.052	-.209	-.027	-.083	.212	.304	-.075	-.036	-.187						
PAR_permissive <sup>g</sup>	-.012	.079	-.370	-.247	.189	.074	.365	-.356	-.408	-.274	.412					
Stress <sup>h</sup>	-.255	-.234	-.405	-.298	-.215	-.087	.035	-.052	.094	.217	.475	.155				
ENG_quantity <sup>i</sup>	-.038	-.203	<b>.684**</b>	<b>.719**</b>	-.109	.173	-.464	.144	.138	-.293	-.233	-.511	-.338			
KOR_quantity <sup>j</sup>	.107	.401	<b>-.516*</b>	-.501	.399	.060	.148	-.001	.004	.383	.180	.207	.331	<b>-.697**</b>		
ENG_quality <sup>j</sup>	.329	.073	.114	.134	.178	.150	-.205	-.222	-.045	-.385	.132	.472	-.188	.032	-.274	
KOR_quality <sup>j</sup>	-.128	.093	-.461	<b>-.707**</b>	.104	-.379	.346	-.120	.015	.307	-.465	.050	-.145	-.449	.330	-.090

REVT-R=Korean receptive vocabulary; REVT-E=Korean expressive vocabulary; PPVT=English receptive vocabulary; EOWPVT=English expressive vocabulary; NWR\_KOR=Korean nonword repetition; NWR\_ENG=English nonword repetition; TEM\_SUR=temperament-surgency; TEM\_NA=temperament-negative affectivity; TEM\_EC=temperament-effortful control; PAR=parenting style; Stress=total parenting stress; ENG\_quantity=total time of mothers' English use; KOR\_quantity=total time of mothers' Korean use; ENG\_quality=total frequency of English activities; KOR\_quality=total frequency of Korean activities.

<sup>a</sup>Receptive and Expressive Vocabulary Test-Receptive (Kim et al., 2009), <sup>b</sup>Peabody Picture Vocabulary Test-IV (Dunn & Dunn, 2007), <sup>c</sup>Expressive One Word Vocabulary Test-4 (Martin & Brownell, 2011), <sup>d</sup>Korean NWR task (Yim & Han, 2019), <sup>e</sup>English NWR task (Yim et al., 2016), <sup>f</sup>Children's Behavior Questionnaire-Very Short Form (Putnam & Rothbart, 2006), <sup>g</sup>Parenting Styles and Dimensions Questionnaire (Robinson et al., 1995), <sup>h</sup>Parenting Stress Index, Fourth Edition Short Form (Abidin, 2012), <sup>i</sup>Language Environment Questionnaire (Yim et al., 2020; Paradis, 2011).

\* $p < .05$ , \*\* $p < .01$ .

tively correlated with Korean NWR ( $r = .789, p < .001$ ) and English NWR ( $r = .640, p = .010$ ).

English receptive vocabulary skills were positively associated with English NWR ( $r = .629, p = .012$ ) and quantity of mothers' English input ( $r = .684, p = .005$ ) but were negatively associated with surgency ( $r = -.651, p = .009$ ) and quantity of mothers' Korean input ( $r = -.516, p = .049$ ). English expressive vocabulary skills were positively correlated with English NWR ( $r = .625, p = .013$ ) and quantity of mothers' English input ( $r = .719, p = .003$ ) but were negatively correlated with surgency ( $r = -.650, p = .009$ ) and quality of Korean input ( $r = -.707, p = .003$ ).

Among the internal and external factors, Korean NWR was positively correlated with English NWR ( $r = .658, p = .008$ ). Also, quantity of mothers' English input was negatively correlated with quantity of mothers' Korean input ( $r = -.697, p = .004$ ).

#### Internal and External Predictors of Korean Vocabulary Skills: Korean Monolingual Children

In stepwise regression analyses, we predicted Korean receptive and expressive vocabulary skills in Korean monolingual children using internal factors (percentages of three dimensions of temperament, Korean NWR) and external factors (percentage of total parenting stress, three dimensions of parenting style, quantity of mothers' Korean input and quality of Korean input) as independent variables. The results indicated that one of the temperament dimensions, effortful control, accounted for 29.6% of the variance

**Table 5.** Results of stepwise regression predicting Korean receptive vocabulary skills in Korean monolingual children

Predictor	Unstandardized coefficients		Standardized coefficients	$R^2$	Adj $R^2$
	$B$	$SE$	$\beta$		
Model 1 Effortful control	.984	.271	.566	.321	.296*

\* $p < .01$ .

**Table 6.** Results of stepwise regression predicting Korean expressive vocabulary skills in Korean monolingual children

Predictor	Unstandardized coefficients		Standardized coefficients	$R^2$	Adj $R^2$
	$B$	$SE$	$\beta$		
Model 1 Effortful control	1.158	.239	.676	.456	.437*

\* $p < .001$ .

in Korean receptive vocabulary skills ( $F_{(1,28)} = 13.219, p = .001$ ). Moreover, the predictor of Korean expressive vocabulary skills was also effortful control, accounting for 43.7% of the variance ( $F_{(1,28)} = 23.506, p < .001$ ). Tables 5 and 6 present the results of these stepwise regressions.

#### Internal and External Predictors of Korean and English Vocabulary Skills: English-Korean Bilingual Children

In stepwise regression analyses, we predicted Korean receptive and expressive vocabulary skills and English receptive and expressive vocabulary skills in English-Korean bilingual children using internal factors (percentages of three dimensions of temperament, Korean and English NWR) and external factors (percentage of total parenting stress, three dimensions of parenting style, quantity of mothers' English and Korean input and quality of English and Korean input) as independent variables. We found that effortful control accounted for 45.8% of the variance in Korean receptive vocabulary skills ( $F_{(1,13)} = 12.831, p = .003$ ) and that Korean NWR accounted for an additional 18.4% of the variance, together accounting for 64.2% of the variance ( $F_{(2,12)} = 13.555, p = .001$ ). Furthermore, Korean NWR accounted for 59.3% of the variance in Korean expressive vocabulary skills ( $F_{(1,13)} = 21.408, p < .001$ ). Tables 7 and 8 present the results of the stepwise regressions addressing Korean vocabulary skills.

**Table 7.** Results of stepwise regression predicting Korean receptive vocabulary skills in English-Korean bilingual children

Predictor	Unstandardized coefficients		Standardized coefficients	$R^2$	Adj $R^2$
	$B$	$SE$	$\beta$		
Model 1 Effortful control	.899	.251	.705	.497	.458*
Model 2 Effortful control	.725	.213	.569	.693	.642*
Korean NWR	1.285	.464	.464		

\* $p < .01$ .

**Table 8.** Results of stepwise regression predicting Korean expressive vocabulary skills in English-Korean bilingual children

Predictor	Unstandardized coefficients		Standardized coefficients	$R^2$	Adj $R^2$
	$B$	$SE$	$\beta$		
Model 1 Korean NWR	3.627	.784	.789	.622	.593*

\* $p < .001$ .

**Table 9.** Results of stepwise regression predicting English receptive vocabulary skills in English-Korean bilingual children

	Predictor	Unstandardized coefficients		Standardized coefficients	$R^2$	Adj $R^2$
		<i>B</i>	<i>SE</i>	$\beta$		
Model 1	Quantity of mothers' English input	.207	.061	.684	.467	.426*
Model 2	Quantity of mothers' English input	.180	.046	.593	.736	.692**
	English NWR	1.873	.536	.526		

\* $p < .01$ , \*\* $p < .001$ .**Table 10.** Results of stepwise regression predicting English expressive vocabulary skills in English-Korean bilingual children

	Predictor	Unstandardized coefficients		Standardized coefficients	$R^2$	Adj $R^2$
		<i>B</i>	<i>SE</i>	$\beta$		
Model 1	Quantity of mothers' English input	.179	.048	.719	.517	.480*
Model 2	Quantity of mothers' English input	.157	.035	.630	.776	.738**
	English NWR	1.508	.406	.516		
Model 3	Quantity of mothers' English input	.125	.033	.502	.850	.809**
	English NWR	1.213	.369	.415		
	Quality of Korean input	-.754	.323	-.325		

\* $p < .01$ , \*\* $p < .001$ .

With respect to the English language, the regression results indicated that quantity of mothers' English input accounted for 42.6% of the variance in English receptive vocabulary skills ( $F_{(1,13)} = 11.404$ ,  $p = .005$ ) and that English NWR accounted for an additional 26.6% of the variance, together accounting for 69.2% of the variance ( $F_{(2,12)} = 16.715$ ,  $p < .001$ ). Moreover, quantity of mothers' English input accounted for 48% of the variance in English expressive vocabulary skills ( $F_{(1,13)} = 13.943$ ,  $p = .003$ ). English NWR accounted for 25.8% of the variance ( $F_{(2,12)} = 20.738$ ,  $p < .001$ ), and quality of Korean input accounted for an additional 7.1% of the variance, together accounting for 80.9% of the variance in English expressive vocabulary skills ( $F_{(3,11)} = 20.759$ ,  $p < .001$ ). Tables 9 and 10 present the results of the stepwise regressions addressing English vocabulary skills.

## DISCUSSION

### Influences on Korean Monolingual Children's Vocabulary Development

For Korean monolingual children, there was a positive correlation between Korean receptive and expressive vocabulary skills and effortful control, a dimension of temperament. This result indicates that children with a stronger ability to control their emotions, attention, and behaviors have stronger vocabulary skills.

This result is in line with a preceding study reporting the positive effect of effortful control on children's vocabulary skills (Palermo et al., 2017). Moreover, effortful control was significantly correlated with authoritative parenting, commonly held as the ideal parenting style in which parents support children with care and clear but flexible rules (Önder & Gülay, 2009). As parents' behaviors and attitudes can influence children's personality and adjustment to their environment (Johnson, 2006), authoritative parenting might contribute to the development of greater effortful control, which in turn benefits vocabulary skills. Phonological working memory, as measured by the NWR task (Yim & Han, 2019), was positively associated with children's expressive vocabulary skills, which is consistent with previous studies examining these variables (Gathercole et al., 1997; Jung & Ha, 2017). Furthermore, there was a significant negative correlation between children's expressive vocabulary skills and surgency, which suggests that high activity level hinders children's vocabulary development.

Effortful control was the only factor predicting Korean monolingual children's receptive and expressive vocabulary skills, which highlights its importance. Specifically, expressive vocabulary was significantly associated with both effortful control and phonological working memory, and there was also a significant relationship between effortful control and phonological working memory. These results indicate that although phonological working memory is

also closely related to expressive vocabulary skills, effortful control appears to influence expressive vocabulary skills more strongly. Thus, future researchers should consider temperament (effortful control, in particular) when assessing vocabulary skills in Korean monolingual children.

### Influences on English–Korean Bilingual Children’s Vocabulary Development

The results of this study indicated that bilingual children’s effortful control was positively associated with Korean receptive vocabulary skills. This aligns with the previous finding that effortful control increased the probability of being distinguished in high-balanced Spanish-English bilingual children (Palermo et al., 2016). There was a significant negative correlation between surgency and these children’s English vocabulary skills, indicating that children demonstrating higher levels of activity and lower levels of shyness are less proficient with English vocabulary. Phonological working memory for both languages was positively correlated with children’s Korean vocabulary skills, and phonological working memory in English was positively correlated with children’s English vocabulary skills. Similar to previous studies investigating the relationship between phonological working memory (as measured by NWR) and vocabulary skills in bilingual children, there were more associations between the former and the latter within each language than there were across languages (Lee, Kim, & Yim, 2013; Parra, Hoff, & Core, 2011; Pham & Tipton, 2018). This can be interpreted as evidence that performance on NWR in each language is affected by the corresponding language experience (Parra et al., 2011).

Furthermore, the language environment appears to play an important role in bilingual children’s English vocabulary skills. There was a significant correlation between bilingual children’s English receptive and expressive vocabulary skills and quantity of mothers’ English input. This result aligns with previous studies reporting a positive correlation between mothers’ language use and vocabulary skills in bilingual children (Pham & Tipton, 2018; Tsai et al., 2012). In other words, the more mothers use their L1 (English in this case), the greater children’s proficiency with English vocabulary. Thus we can predict that mothers’ native L1 input provides a greater database for children’s vocabulary development (Hoff et al., 2020). However, quantity of mothers’ Korean input was nega-

tively correlated with children’s English receptive vocabulary skills. This result indicates that when mothers use Korean and it is not mother’s L1, it hinders children’s English vocabulary skills. Again, this suggests the importance of L1 use at home. Moreover, there was a negative association between quality of Korean input and English expressive vocabulary skills. In other words, more frequent engagement in Korean-enrichment activities negatively impacts children’s English expressive vocabulary skills. Although this result does not accord with previous studies’ detection of a positive correlation between frequency of participation in language-based activities and vocabulary skills in that language (Paradis, 2011; Pham & Tipton, 2018), it does suggest positive associations between quality of language input and vocabulary outcomes within a language rather than across languages.

Internal factors—effortful control and phonological working memory—significantly predicted bilingual children’s Korean vocabulary skills. Hence, similar to Korean monolingual children, effortful control influenced their Korean receptive vocabulary skills. Unlike factors influencing monolingual children’s and bilingual children’s Korean vocabulary skills, mothers’ L1 use played an important role in their English vocabulary skills. Thus, it is necessary to examine mothers’ language use at home when investigating children’s vocabulary skills, considering that it can facilitate such skills. Furthermore, phonological working memory predicted bilingual children’s vocabulary skills. As bilingual children’s knowledge in each language reflects the results of the standardized tests (Kohnert, Windsor, & Yim, 2006), using various processing tasks is one way to reduce the possibility of misdiagnosing bilingual children (Leonard, 1998). Thus, as a phonological processing task, NWR should be considered as a clinical tool for assessing bilingual children.

### Limitations and Directions for Future Research

This study had several limitations that could be addressed in future studies. First, a total of only 45 children participated in the study. As this was a relatively small sample, future studies should recruit more participants to increase generalizability. Second, the bilingual children who participated in this study were simultaneous bilinguals who had been exposed to English from the mother and Korean from the father since they were born. Therefore, it is

difficult to generalize this study's results to other bilingual groups such as sequential bilinguals who use their L1 at home and their L2 at school. Thus, future studies should examine factors that support vocabulary skills in different groups of bilingual children. Third, in order to investigate the effect of quantity of input on children's vocabulary skills, we analyzed only the quantity of mothers' English and Korean input. We could gain useful insights from also examining the effect of fathers' language input on children's vocabulary skills. Finally, we classified participants as monolingual or bilingual based on their language use. Thus, future researchers might consider classifying participants by their vocabulary proficiency to generate even more insights about children's vocabulary development.

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## 국문초록

### 아동의 기질, 음운작업기억, 어머니 관련 요인 및 언어환경이 한국어 단일언어아동과 영어-한국어 이중언어아동의 어휘발달에 미치는 영향

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**배경 및 목적:** 본 연구는 내적 및 외적 요인이 한국어 단일언어아동과 영어-한국어 이중언어아동의 어휘발달에 어떤 영향을 미치는지 살펴보고, 각 집단의 어휘능력을 예측하는 요인을 알아보고자 하였다. **방법:** 3-6세의 한국어 단일언어아동 30명과 영어-한국어 이중언어아동 15명, 총 45명의 아동이 본 연구에 참여하였다. 아동의 어휘능력을 알아보기 위해 표준화된 어휘 검사들을 실시하였다. 내적 및 외적 요인을 살펴보기 위해 아동들은 비단어 따라말하기 과제(NWR)를 수행하였고, 아동의 어머니는 기질, 양육스트레스, 양육행동, 언어환경 설문지를 작성하였다. **결과:** 단일언어아동은 내적 요인과 한국어 어휘능력 간 유의한 상관관계가 나타났고, 의도적 통제는 한국어 어휘능력의 예측 요인이었다. 이중언어아동은 내적 요인과 한국어 어휘능력 간 유의한 상관관계가 나타났고, 의도적 통제와 한국어 NWR 점수는 한국어 수용어휘능력의 예측 요인이었으며, 한국어 NWR 점수는 한국어 표현어휘능력의 예측 요인이었다. 또한, 이들의 영어 어휘능력과 내적 및 외적 요인 간 유의한 상관관계가 나타났다. 어머니의 영어 입력의 양, 영어 NWR 점수는 영어 수용어휘능력의 예측 요인이었고, 어머니 영어 입력의 양, 영어 NWR 점수, 어머니의 한국어 입력의 질은 영어 표현어휘능력의 예측 요인이었다. **논의 및 결론:** 어휘능력을 살펴볼 때, 단일언어아동은 의도적 통제의 영향을 고려하고, 이중언어아동은 가정에서의 어머니 언어 사용의 영향을 고려할 필요성을 제안한다. 또한, NWR 과제를 평가 도구로 사용하여 이중언어아동의 언어능력을 종합적으로 평가할 것을 제안한다.

**핵심어:** 기질, 음운작업기억, 어머니 관련 요인, 언어환경, 어휘발달, 이중언어아동

이 논문은 2021년 대한민국 교육부와 한국연구재단의 지원을 받아 수행된 연구임(NRF-2021S1A3A2A01096102).

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