Metalinguistic Skills of Children with Varying Language Abilities

A Thesis

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By

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Abstract

This study examined the differences between the performance on metalinguistic tasks between children with typical language development and those with weak language skills. Research Bilingual children will be used as a base for stronger metalinguistic abilities and I will discuss what bilingual children's metalinguistic abilities taught researchers and how it applies to monolinguals and monolinguals with language impairment. Studies also typically use normal language acquiring monolingual children as a control group to compare to bilinguals and/or monolinguals with language impairment. Results indicate that bilinguals have the strongest metalinguistic abilities and monolinguals with language impairment the lowest. I then will include my own research done in Dr. Lizbeth Finestack's Child Language Lab, comparing monolingual typically developing and low language skilled children between the ages of 4-8 years. This study will use a variety of examinations, looking at verbal skills, nonverbal skills, low-language skills, and metalinguistic skills. The paper concludes that monolinguals with low language skills have impaired metalinguistic skills which influences the strength of their verbal language abilities.

Introduction

Research regarding bilingual children shows that their metalinguistic awareness skills correlate with their executive functioning. Strong metalinguistic abilities correlate with strong executive functioning, and vice versa. In this study, I examined if this relationship also exists for monolingual children with and without language impairment. In addition, I will compare groups of language abilities: bilinguals, monolinguals without language impairment, and monolinguals with language impairment, to see if the level of one's language ability also plays a role in the strength of metalinguistics/executive functioning. I hypothesize that monolingual children will exhibit stronger metalinguistic skills and stronger executive functioning than compared to monolingual children with language impairment.

Definitions

According to Bialystok (1986), "metalinguistic ability is defined in terms of the development of two language skill components—the analysis of linguistic knowledge and the control of linguistic processing" (p. 498). According to Connell et al. (1982), language is defined as a "complex and dynamic system of conventional symbols that is used in various modes for thought and communication" meaning that can change over time and is arbitrary depending on the culture and context that uses it. Neurological analysis of language can include specific abilities such as memory, network organization, and control over executive functioning (EF). EF includes cognitive processes such as planning, flexibility of thought, inhibition of thought and response, fluency, and working memory. "In other words, processes that control and regulate thought and action" according to Henry et al. (2011). More specifically, inhibition can be defined as the ability to stop one task or behavior at will or a lack of impulsivity or ability to control one's impulses; updating or working memory is the ability to retain/recall information for future tasks; and shifting or cognitive flexibility is the ability to move between tasks freely and react appropriately to either task.

Investigators believe that there is a close relationship between metalinguistic skills and executive functioning. The stronger each component is within executive functioning, the stronger the linguistic control. These abilities are also tied to conversation and literacy success as well as making explicit the implicit knowledge of language-mastery. This is important as children begin to acquire language and make fluid connections between the form, content, and use. Form includes syntax, morphology, and phonology; content includes semantics; and use includes pragmatics. Awareness in phonology "is significantly related to a child's ability to learn to read… [and] manipulate the sound structure of words" (Mann & Liberman, 1984; Wagner & Torgesen, 1987; Carlisle & Nomanbhoy, 1993). In turn, morphological awareness is tied then to the sensitivity of the child to changes in phonemes. These two components primarily affect a child's ability to learn to read and then later in life when reading to learn. The following studies examine the relationships between X and X across a variety of these components of language. Most research examining the relationship between metalinguistic skills and EF focuses on bilingual children. Thus, the following literature review begins with an overview of these relationships based on bilingual children. This is followed by a review of studies examining metalinguistic and EF in typically developing children and children with language impairment.

EF and Metalinguistic Skills of Bilingual Children

Bialystok and Viswanathan (2009) examined the EF skills of bilingual children from two different cultures. The study included 90, 8-year olds, mostly from Canada and educated in English. The bilingual children spoke another language at home that was one of the following: Cantonese, Croatian, French, Hebrew, Hindi, Kannada, Mandarin, Marathi, Punjabi, Russian, Tagalog, Telugu, or Urdu. Researchers also examined another group of bilinguals from India that spoke both English and Tamil. There was also a control group of monolingual English speakers.

Children completed the Peabody Picture Vocab Test, third Edition (PPVT-III, Dunn & Dunn, 1997), and other EF tasks, such as a short-term memory task to recall a list of animals; a working memory task to reorder numbers one through twenty; a spatial memory task using Corsi blocks; and a trail-making task (TMT). For the TMT, examiners placed the numbers one through twenty-one and letters "A" through "L" in front of each child in a random order. The first component of the task was to connect the numbers one to twenty-one in numerical order and the second component was to alternate between numbers one through twelve and all the letters (ex: A, 1, B, 2, etc.) This task used the measurement of how many seconds it took to complete. These tasks measured a variety of skills that fall strictly within EF and look at more than just one skill. The measurements were in seconds to complete the task and depending on the task, such as recalling a list of animals, the number of correct items (e.g., how many animals he/she could list correctly in a row).

The second part of the test was a faces task. Children looked at a screen and a face would appear for 1000 ms, the eyes turned either red or green for 500 ms, the screen became blank for 200 ms, and then an asterisk appeared on the screen depending if the eyes were red or green. The children pressed a key on the same side of the screen as the asterisk. There were 16 blocks with 24 trials in each block and each block could contain a mixture of which side the asterisk was on, or all 24 where the asterisk was on the same side. Each change in the face task measured a different component of EF: a difference between red eyes and green eyes measured suppression; a shift in gaze versus straight gazing eyes measured inhibition; and the presence of mixture in each block of trials measured switching.

The English monolingual children outperformed their bilingual counterparts on the PPVT-III as expected. There was no difference between the monolingual and bilingual children on the animal recall, number sequencing, or spatial memory tasks. However, the bilingual children outperformed the monolingual children on both components of the TMT. On the face task, the bilinguals were faster to identify the appropriate side of the screen in mixed blocks, although there was a 97-98% mean accuracy across all groups. The bilingual children were better at the tasks that require inhibitory control and switching, but not response repression. The response repression component of EF was not significantly different between the monolingual and bilingual children.

The most important piece of information that the researchers found was that despite being a part of two different cultures, backgrounds, and even languages, the bilingual children performed nearly the same on all the tasks. Therefore, it could be concluded from this study that the specific language or culture does not affect performance on measures EF. The bilingual children, regardless of level of bilingualism or culture, outperformed all the monolinguals. However, this study does not address the level of bilingualism between the two bilingual groups.

In another study, Bialystok et al. (1988) examined if the level of bilingualism affects performance on awareness tasks. The investigators hypothesized that bilingualism would only be an advantage to fully bilingual children rather than partial bilingual children. The study included 57 children between 6 and 7 years of age. There were 20 monolingual English-speakers, 20 partially French-English bilingual speakers, and 17 fluent French-English bilingual speakers. The bilingual French speakers attended a French school, but the time spent being educated in school in French and levels of French used outside the home varied between the fully bilingual speakers and the partially bilingual speakers.

Similar to the previous study, researchers administered the PPVT to all of the children and a French version of the PPVT to the bilingual children. Children completed three tasks, the first being Piaget's (1929) sun/moon task using the words "cat" and "dog." The experimenters asked the children to swap the words and answer questions like "what sounds would a cat make?" A word concept task was next, during which the researchers presented the children with 10 words/phrases, asked if each was a word, and to justify their response. The children then defined a "word." Finally, all groups listened and responded to 12 sentences, each with their own grammatical errors, and the child had to repeat the sentence correctly back to the proctor.

As expected, the English monolingual children scored the highest on the PPVT and the fully French bilingual children scored higher than the partial bilinguals did on the French PPVT. Across the tasks, the fully bilingual group always consistently had the strongest performance and the monolingual group had the lowest (Bialystok, 1988). The fully bilingual group was superior across all tasks in comparison to the other groups.

Between these two studies, there is a similarity in age of the participants as well as the type of tasks administered to measure metalinguistic abilities. The control of linguistic processing can be seen in tasks such as Piaget's sun/moon task where the children need to be able to control their definitions of words/concepts, but then using flexibility to return to the prescribed definitions after the task is over. The second study expands upon the first study in that the level of bilingualism affects the strength of metalinguistic awareness, but the language itself does not affect the performance on tasks. Bilinguals are important to analyze as they provide insight into how or why children can gain a stronger metalinguistic skill set.

EF and Metalinguistic Skills of Monolingual Children

The next question to ask is whether a higher functioning metalinguistic skill set can be found in monolinguals and if so, what differences are found between monolinguals and bilinguals. One study looks just at phonological and morphological awareness, specifically in first graders. The students, 59 boys and 43 girls, completed a variety of tasks to test the form component of language, which is directly tied to the level of EF. Tasks included a judgement of word relations task which measured a child's ability to detect semantic and/or phonological similarities in word families; a production of word form task which measured the ability to produce grammatically or semantically correct sentences through means of plurals, superlatives, and derived words; a picture identification test in which the experimenters asked the children to identify pictures of correctly or incorrectly labeled words in the word relations judgement task; and a test of auditory skills to assess if a child can delete specific morphemes from provided words and separate the meanings of the old words with the new ones.

Results found that in the word form test, children were better at producing inflections of words than when the word changed phonologically. Across all tasks, morphologically-related words posed fewer problems than those words with added/deleted phonemes. For example, children performed better with word changes such as "wash" to "washer" or "washed" than if the base word was "moth" and changed to "mother." The added morpheme /er/ in this instance, as well as other words used on the tasks, are what the children had most trouble with. This "morphological awareness may be contributed to understanding reading… performance on phonological awareness task contributed most significantly to variance in word-reading ability" (Carlisle & Nomanbhoy, 1993). It could be concluded from this test that differences in metalinguistic abilities could affect morphological and phonological awareness; however, the study does not have conclusive evidence to determine whether phonological awareness has lasting impacts on morphological learning abilities.

William E. Tunmer says in his study on metalinguistic abilities in relation to beginning reading (or learning to read), that “as more words are correctly [learned,] children’s knowledge of the letter-sound correspondences would increase. This… may be especially important for learning more complex rules [of reading]” (Tunmer, Herriman & Nesdale, 1988). Tunmer’s study also looks at first graders, but in a longitudinal study over two years as the children were in the beginning stages of learning to read. Within his study, experimenters administered phonological, syntactic, and pragmatic tasks and the results show that the children did significantly better on the pragmatics task, then the syntactic task, and finally the phonological task. It is hypothesized that the children did the best on the pragmatics task because that is the main way in which they had learned language up until the point in life where they began to learn to read. In general, though, the children did improve their performance in letter identification as the children gained deeper knowledge in reading, as expected at the beginning of the study.

The most interesting aspect of the study though is that some preliterate children acquired the ability of segmentation during the time of the study, while others did not. The authors gave a possible explanation to this to the level of operativity, which is defined in the study as “the ability to control the course of one’s thought,” similar to inhibition (137). The authors then conclude that the ability to gain metalinguistic skills is dependent on the level of their individual operativity. Looking at the previous study tied into this one, because phonemes play an important role in learning certain morphemes, and both fall into the category of a component of EF, it is expected that the level of operativity affects morphological learning abilities, and if low functioning, morphological as well as phonological awareness will suffer (as well as perhaps other aspects of language).

EF and Metalinguistic Skills of Monolingual Children with Language Impairment

Strong relationships between EF, metalinguistic skills, and language development also exist for children with language impairment. Kamhi (1987) gives insightful background into the importance of metalinguistic skills in language development. He notes that language impaired children typically have problem with repairing communication breakdowns. “The ability to repair communicative breakdowns is important for maintaining and regulating discourse… self-initiated spontaneous repair occur very early in children’s speech” but is an important missing component in the speech of the language-impaired (Kamhi, 87).

In another study, Kamhi and Koenig (1985) compared the metalinguistic awareness skills of children with typical development and children with language-impairment. The study included 10 children with language impairment (seven boys and three girls), and 10 children with typical development (six boys and four girls), who were between the ages of four years and seven years, two months. A speech-language pathologist as having a primary language disorder, not because of globally lower mental functioning, emotional disturbances, hearing loss, or physical impairments, had diagnosed the children with language-impairment. All the children completed the Northwestern Syntax Screening Test to measure the receptive language and the PPVT to measure receptive vocabulary. The typically developing group scored higher on both tests, but there were no significant differences when comparing the scores between the two groups.

The metalinguistic task comprised 28 randomly arranged sentences: seven with a semantic error, seven with a phonological error, seven with a syntactic error, and seven with no error. The sentences varied in grammatical structure to include past tense, present progressive tense, possessives, third person singular, negation, and interrogative reversals (who, what, when, where, why questions). Children asked a puppet to help correct the incorrect sentences. Experimenters first asked the children if the sentence was correct or incorrect, and then if incorrect, what needed to change. Researchers transcribed all responses and compared the live transcriptions to the taped transcriptions after the testing was complete.

After first comparing results within each group separately, experimenters found that for the children with language impairment, there was a significant difference in the ability to identify and correct the incorrect sentences. The children had the greater difficulty identifying sentences that had a syntactic error than a phonological or semantic error. The phonological errors were also harder to correct than semantic errors. The children with typical development did not demonstrate significant difference in their ability to identify any error in the three types of erroneous sentences.

Between groups, the children with language impairment and typically developing children did not differ significantly in their ability to find and correct the semantic and phonological errors within a sentence. The children with typical development were significantly better in their ability to identify and correct syntactic errors, which is consistent with the results of Liles et al. (1977). Some reasons provided as to why the children with language impairment did not perform as well as their peers with typical development on syntactic error identification included that "language-disordered children could not produce the targeted syntactic structures with the same proficiency as the normal children… [due to an inability] to use attention-demanding processes to access different levels of linguistic knowledge… [or] the need to attend and discern the linguistic unit targeted by the metalinguistic task" (pg. 207). The results were most likely not due to a lack of linguistic context and the children with language impairment should actually be more likely to identify a variety of linguistic elements due to their time in therapy. Most likely, though, researchers attribute this difference to the children with language impairment not having as much knowledge regarding varieties of syntactic forms compared to normal children.

In another study conducted by Johnson et al. (1990), the researchers sampled 16 children between the ages of seven years, eight months to nine years, ten months. Eleven of the children had typical language performance, measured by the Test of Oral Language Development, and five children had below average language abilities. All participants score within the average range on nonverbal intelligence scales as determined by standardized tests. None of the children had hearing loss, emotional disturbances, or oral structural defects. The experimental task required the children to learn two miniature languages, each with their own set of rules. One system employed the structure of action + agent + patient (Language I or L1), and the other agent + patient + action (Language II or L2). Words in the languages included four nouns that referenced fantasy animals with no reference to English words, and three reversible actions whose closest representations in English were *rescue*, *zap,* and *push*; or *carry, kick,* and *throw*. All words were monosyllabic, and the total number of possible sentence combinations in each language was 36. A game setting employed the two miniature languages. Tests concluded when each child could correctly play the game six out of eight times, or until five 20 to 30-minute games occurred.

The investigators grouped the children into three proficiency groups: high, medium, and low with five children in each group (as one child with language impairment had been eliminated due to inability to complete the task). The high proficiency group included children who reached criterion in both languages, medium proficiency group included those who also reached criterion in both languages but was between +/- 1 standard deviation for each trial, and the low proficiency group were those who only reached criterion in one language. The low group included three of the children with language impairment and two children with typical development, with the other children with language impairment in the medium group and the rest children with typical development filling the medium and high group. Language II was easier to use and required fewer trials for children to gain proficiency in it, but experimenters designed both languages to be easily learned by both groups of children for the ages they were. The design, then, was more to explore the effect of perceptual memory through learning a new language.

Two investigators suggested that the children with language impairment children may have performed more poorly than their peers with typical development due to limited abilities in attention shifting and inflexibility, both of which are important components to EF. The children with language impairment seemed to be focused on just one aspect of a language, morphemes, syntax, or semantics, rather than seeing a wider picture of how all the components of the language interact together as well as how L1 differs from L2 in these respects. There was an absence of any prior disposition to L1 or L2 and the children with language impairment had more difficulty finding similarities to the created languages as well as English, which may have aided the typically developing children in succeeding in the task.

Skarakis-Doyle and Dempsey (2008) conducted a study to examine the comprehension of a preschool population, specifically in error detection and correction, within the context of stories. Participants included 37 children between the ages of 30 and 61 months who were in one of the following groups: 10 children (eight boys and two girls) with language impairment (LI); 13 children (six boys and seven girls) with typical development matched based on age (TDA);

and 14 children (two boys and twelve girls) with typical development matched based on receptive vocabulary (TDY). The PPVT-III was used to measure normal language. All the children had English as their primary language and story-reading was a component of each child's daily routine. Each child listened to the story, "Splish Splash," and then asked to identify eight elements in the original story that changed or were wrong. After completing the story, children answered 11 interrogative reversals. If the child could not answer the question, researchers asked a reformulated question in a "yes/no" answer format. Finally, the children listened to books, which were provided by the parents, and asked to stop the researcher if he/she said something that did not fit the story.

Results indicated that there were significant differences between the LI, TDA, and TDY groups on all tasks. "Literature suggests that children with LI may be generally slow responders (Miller, Kail, Leonard & Tomblin, 2001)… [so the researchers] first examined the amount of time that each group of children required to complete the task" (Skarakis-Doyle & Dempsey, 2008). The mean time for the groups (in minutes and seconds) were LI = 2:57, TDA = 2:39, TDY = 2:20. The children with typical development responded, on average, 18 to 37 seconds faster than the children with language impairment, however this was not a significant difference.

Group comparisons indicated that the LI group performed more poorly than the TDA and TDY groups despite not differing from the TDY group based on receptive vocabulary or vocabulary related specifically to the stories. The TDA group, when compared to the LI group, was able to identify and correct over 50% more errors in the stories. Researchers found that the LI group had both expressive and receptive vocabulary impairments, giving reason to this significant difference.

The authors contribute "that understanding the story content and gist… is one of several contributing variables to the [task] performance but does not provide the largest unique contribution" (pg. 1238). The most interesting component to the authors was how EF is related to non-verbal communicative abilities. The children with LI had a harder time making connections and exhibiting strong EF characteristics when compared to their control group counterparts. However, LI children have been shown in previous studies to exhibit similar scores on non-verbal communicative tasks but achieving these scores in different ways. The authors suggest that the role metalinguistic abilities have in this particular study is necessary "for multiple source of knowledge and cognitive processes required for goal-directed behavior" and particularly, comprehending basic stories is crucial to learning a language in all components (form, content, and use). The ability to participate in conversation and reading later in life is compromised if children with LI cannot understand.

The three studies, which included monolingual children with language impairment ranging from preschool age (~ four years) to eight years old, revealed that the children with LI did not perform as well as their monolingual non-LI counterparts. Using a variety of tasks to test phonemic and morphemic awareness, syntactic and semantic correction, and the use of these language in story or game settings, EF is compromised.

Current Study

This review of the literature suggests that bilinguals exhibit the strongest EF characteristics, contributing to strong metalinguistic skills. When comparing monolinguals to bilinguals, the bilinguals always outperform their monolingual counterparts. In addition, in the few studies shown comparing monolingual LI kids to monolingual non-LI kids, the non-LI kids outperformed the LI kids. However, what remains to be known is quantitative data that reveal to what extent monolingual non-LI kids outperform the LI kids. In addition, little is known when comparing non-verbal to the verbal skills of LI and non-LI participant groups.

Method

Participants

This study included 122 children between the ages of 4 and 8 years. Half of the sample included children with weaknesses in language ability and half had no indications of language weakness. There were 24 4-year olds, 12 5-year olds, 30 6-year olds, 24 7-year olds, and 32 8-year olds. These children were selected from a database from Dr. Lizbeth Finestack's Child Language Intervention Lab that includes a total of 561 children, ranging from 3 to 9 years of age. Each of the 61 children with low language (LL) had a typical developing (TD) match, based on gender, ethnicity, race, language(s) spoken at home and the degree each language is spoken, and nonverbal IQ raw scores within 5 points. The Matrices subtest of the Kaufman Brief Intelligence Test – Second Edition; (KBIT-2; Kaufman, 1997) was used as a measure of nonverbal IQ.

The 61 children with LL met the following criteria: (a) not currently receive speech-language pathology services and (b) achieved a standard score (mean = 10; SD = 3) of 7 or below on the Recalling Sentences subtest of the Clinical Evaluation of Language Fundamentals – Fourth Edition (CELF-4). Additionally, parents of children in both groups had to indicate that their child has normal hearing for the child to be included in the current study. See Table 1 for more detailed descriptions of the study participants. Participants were recruited from the Minnesota State Fair between 2012 – 2016. Parents completed several questionnaires and the children completed the KBIT – 2 to assess nonverbal IQ test; the CELF – 4 to assess expressive language; and a researcher-designed probe with four tasks to assess metalinguistic skills.

Children received a stuffed animal for completing the study.

Table 1. Participant Characteristics

Characteristic		Age Group					
		4 - 5		6 - 7		8	
		LL *n* = 18	TD *n* = 18	LL *n* = 27	TD *n* = 27	LL *n* =16	TD *n* = 16
Age (months)							
	Mean	57.89	58.61	83.11	83.10	100.69	100.81
	SD	7.15	7.11	5.80	6.22	2.91	3.19
	Min - Max	48.0 - 71.0	48.0 - 71.0	72.0 - 94.0	73.0 – 95.0	96.0 - 105.0	96.0 - 105.0
	p-value	0.76		0.98		0.91	
	d	0.10		< 0.00		0.04	
Gender							
	Male : Female	10:8	9:9	17:10	17:10	7:9	7:9
Race							
	White	11	11	11	9	14	13
	African American	2	1	1	1	0	0
	Hispanic	2	0	0	2	1	0
	Asian	0	1	0	0	1	0
	Multi	1	5	3	0	0	2
	Unknown	1	0	0	0	0	0
Income							
	<25K	3	0	5	0	0	1
	25 - 50K	3	5	3	2	1	0
	50 - 100K	6	9	9	11	6	5
	100 - 150K	4	2	6	7	6	6
	>150K	2	2	4	5	3	4
	Unknown	0	0	0	2	0	0
KBIT: Standard Score							
	Mean	100.72	94.89	95.74	100.74	101.50	103.56
	SD	10.86	21.10	14.72	12.50	15.56	15.08
	Min - Max	83.0 - 124.0	54.0 - 138.0	76.0 – 127.0	76.0 – 127.0	74.0 - 116.0	70.0 - 127.0
	p-value	0.30		0.18		0.71	
	d	0.35		0.37		0.13	
RSS: Standard Score							
	Mean	5.72	12.06	6.11	11.48	5.81	12.38
	SD	1.71	2.18	1.16	2.87	1.28	2.85

Min - Max	2 - 7	8 - 16	3 - 7	8 - 19	3 - 7	9 - 18
p-value	0.00		0.00		0.00	
d	3.24		2.45		2.97	

General Procedure

Children were tested in about a 30-minute period. Research assistants administered three tasks: the Matrices subtest of the KBIT-2, the Recalling Sentences subtest of the CELF-4, and a metalinguistic awareness probe compiled by Dr. Finestack. Tasks were later scored using procedures specified in the assessment manuals. A child was paired with a student researcher from the University of Minnesota and the pair sat at a table with an iPad, two pairs of headphones, either a video camera or audio recorder, the appropriate materials for each assessment, and a score sheet for all assessments. All audio was recorded to review later for scoring purposes. All tasks were either scored on site or after the Minnesota State Fair had ended. Data entry was completed by two different trained student researchers to prevent data entry errors.

Parent Demographic Questionnaire

The parents completed a questionnaire to provide information about their child, such as age, sex, ethnicity, language(s) spoken at home, and number of siblings. In addition, the child's history was provided, including questions regarding if hearing is typical and if the child had received SLP services previously or is currently receiving. Parents also provided information about their household, including family income level and maternal/paternal education level.

Child Assessments

KBIT-2. When administering the KBIT-2, only the non-verbal section was completed. Using the scoring sheet and easel, the research assistant asked children to point to a picture or say the letter of the picture that completed a visual pattern. The 46 pages on the easel are arranged from easiest to hardest and include meaningful (people and objects) and abstract (symbols and shapes) stimuli. Each page contains multiple choices, so the child must understand relationships and patterns in order to continue the task. The child's age determines the start point. Scores are either a 1 or 0, 1 representing that the child correctly identified the picture that fits the pattern, or a 0 which means they were incorrect. After 4 consecutive 0s, the student researcher discontinued the assessment.

CELF-4/CELF Preschool-2. Children completed the Recalling Sentences (RS) subtest of the CELF-4 to assess expressive structural language abilities. Either the CELF-4 or CELF Preschool-2 was administered depending on the age of the child: ages 4 and 5 years completed the CELF Preschool-2 and ages 6 through 8 years completed the CELF-4. The research assistant verbally provided up to 20 sentences for the child to repeat, with each sentence progressively becoming more complex. Complexity can be reflected by number of words per sentence, types of words, and syntax. Three practice sentences were given before the task was administered and scored. Each sentence was scored by number of errors committed by child when repeating the sentence, with a maximum score of 4 and a minimum of 0. Each error lowered the score by one point. If five sentences with four errors or more occurred, then the student researcher discontinued administering the assessment.

Metalinguistic Awareness Probe. The primary investigator developed the metalinguistic probe used in this study, drawing from a variety of previous studies. The probe was used to assess a child's knowledge about language through vocabulary and morphological metalinguistic skills. The metalinguistic awareness probe consisted for four tasks: word manipulation task, extension of Piaget's sun-moon task (Piaget, 1929), extension of Berko's Wug task (Berko, 1958), and a shortened version of Bialystok's (1986) grammatical judgement task.

Word Manipulation Task. The Word Manipulation Task was modeled after Chaney's (1992) variant of Smith and Tager-Flusberg's (1982) word differentiation task. Children were asked to help make up a new language. The student researcher showed a picture of an object and renamed it with a nonce word. The researcher then asked the child yes/no questions regarding the object using the new name. For example, the researcher showed the child a picture of a cow on an iPad and asked if the cow could be called a “mib.” The picture of the cow was removed, and the child was asked questions such as, “Can you read a mib?” and “Does a mib ‘moo?’” Each child viewed four different objects, with a total possible score of 16 that could be obtained.

Word Swap Task. The second task, modeled on Piaget’s sun-moon task (Piaget, 1929), included of the original sun-moon word swap, but also included one with “dog” and “cat.” The instructions given to the participants asked them to only change the word for sun and moon, as well as cat and dog, and only the word is changing, the meaning behind the words remain the same. After, a picture appeared on the iPad, the child needed to identify what it was called. For example, when a picture of a sun appeared, the correct identification would be “moon” or if a cat appeared, the correct identification would be “dog.” There was a total of eight questions for this task. This Word Swap task assesses a child’s ability to change labels without changing meaning and controlling impulses when answering.

Wug Task. The third task was an extension of Berko’s Wug task (Berko, 1958). For this task, a student researcher orally presented nonsense phrases or words, and asked the child to complete the phrase or provide the next word that would follow a pattern based on the information previously given. For example, a colored drawing of an unrecognizable bird was shown on the iPad, and the student researcher provided the scripted sentence: “This is a wug,” then shown a picture of two unrecognizable birds, and said, “Now there are two. There are two…” The student researcher gave the child an opportunity to answer, with the correct answer being “wugs.” This task assessed a participant’s awareness and ability to extend rules of language to new and unknown words. There were a total of seventeen items in this task.

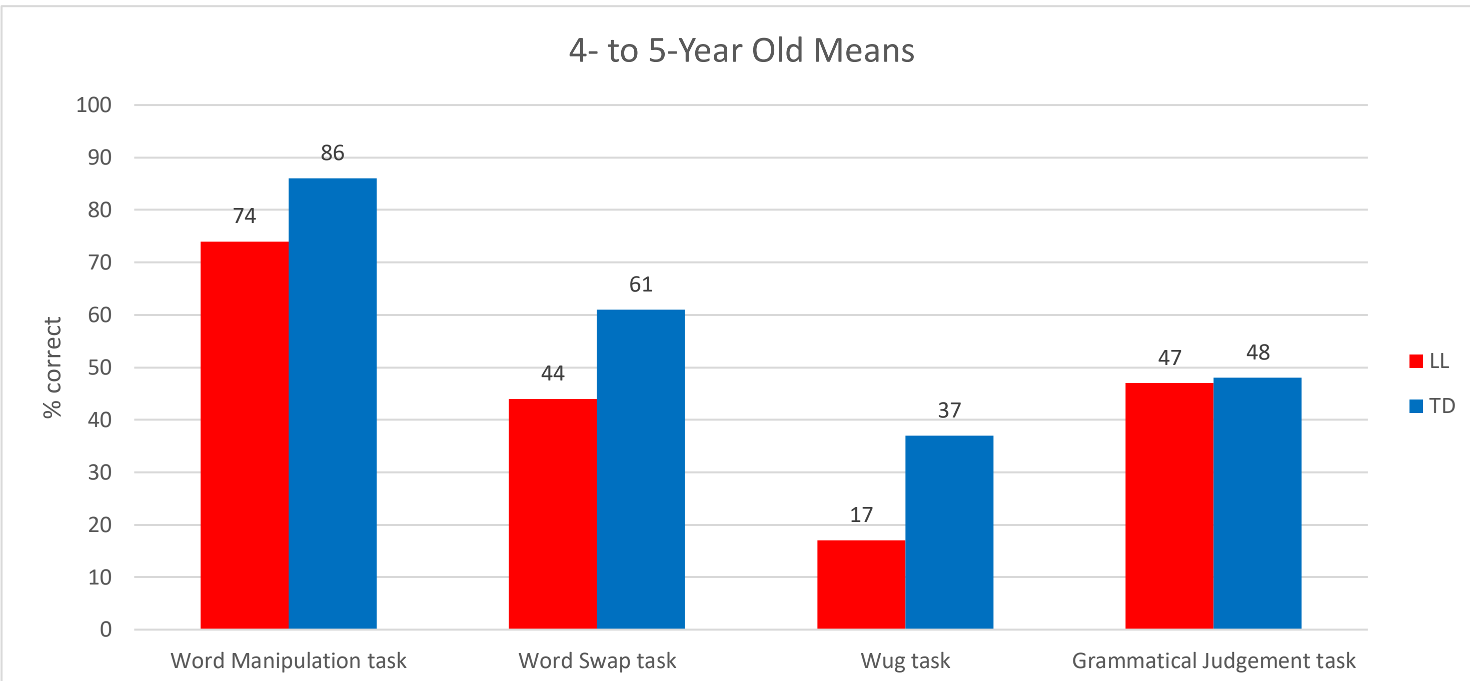
Grammatical Judgement Task. The fourth task was a shortened version of Bialystok’s (1986) grammatical judgement task. The student researchers presented four types of sentences to the examinees: 3 grammatically and semantically correct sentences (i.e. “I have two books”), 3 grammatically incorrect but semantically meaningful sentences (i.e. “I have 2 pencil”), 4 grammatically correct but semantically incorrect sentences (i.e “I drink mud”), and 3 grammatically incorrect and semantically incorrect sentences (i.e. “The shoe are teaching”). The examiner awarded points if the examinee correctly identified all grammatically correct sentences, even if the sentences were meaningless semantically. Examinees had sentences presented to them and they were then asked to answer “yes” or “no” if the sentences could be said. The task aimed to test a child’s ability to separate grammar from semantics through metalinguistic control of impulses, similar to the second task. The goal was for the examinee to override the impulse to answer, “no” for grammatically correct but semantically meaningless sentences, showing a deeper understanding of grammatical judgement.

Results

Study Question 1: When given different metalinguistic tasks, how do the LL and TD kids perform, relative to their age group?

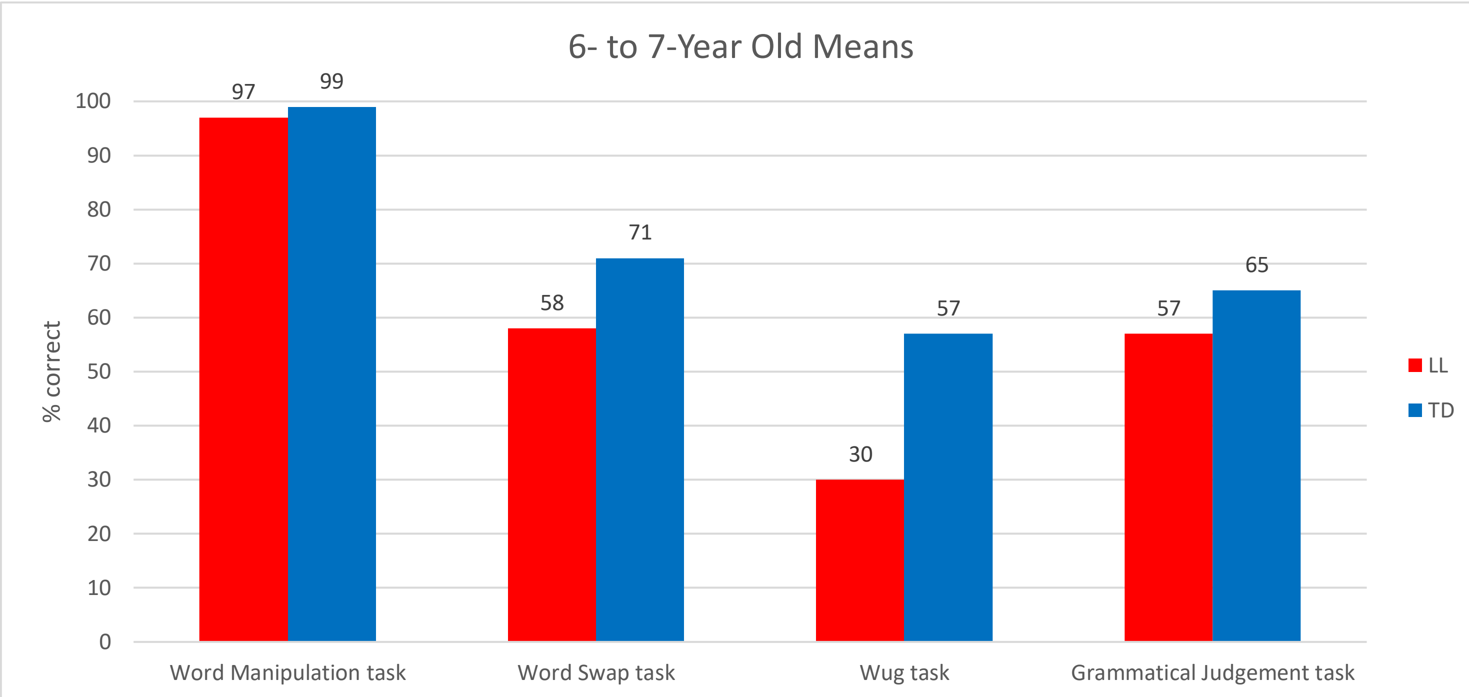
To determine if TD kids consistently outperformed their LL counterparts in metalinguistic abilities, we administered four tasks to assess each age group’s metalinguistic abilities. The tasks progressively became more difficult, and therefore, drew upon stronger metalinguistic skills to complete well. For the 4- to 5-year old group, significant difference between the LL and TD groups emerged for the first three tasks: the Word Manipulation Task (*t*(34) = -2.022, *p* = 0.05), the Word Swap Task (*t*(34) = -2.502, *p* = 0.01), and the Wug Task (*t*(33) = -2.965, *p* = <0.00). No significant difference was found between the groups on the Grammatical Judgement Task, (*t*(32) = -0.178, *p* = 0.87). The mean for the LL children was 47% while for the TD children it was 48%, however the LL children had a greater range of scores (LL min – max: 23%-85%) than the TD children (TD min – max: 23%-69%). Figure 1 shows the differences in means for the 4- to 5-year old group for each task by comparing LL and TD kids.

Figure 1: 4- to 5-year old means



For the 6- to 7-year old group, significant differences were found for the Word Swap Task (*t*(52) = -2.413, *p* = 0.02), the Wug Task (*t*(52) = -4.863, *p* = 0.00), and the Grammatical Judgement Task (*t*(51) = -2.001, *p* = 0.05). Say the direction of the difference. The 6- to 7-year old group did not produce significant results for the Word Manipulation Task (t(52) = -1.027, p = 0.31). Figure 2 shows the difference in means the 6- to 7-year old group by comparing LL and TD kids.

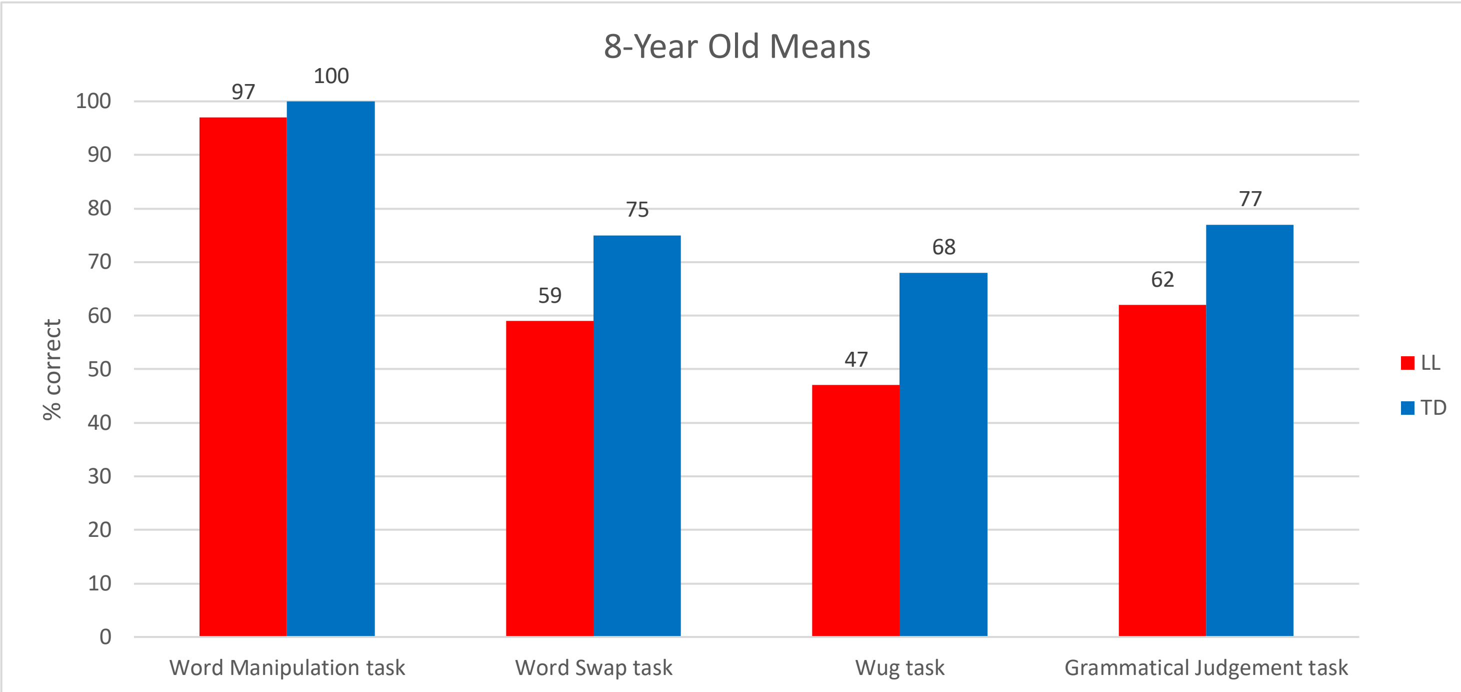
Figure 2: 6- to 7-year old means



For the 8-year old group, significant group differences emerged for three of the tasks: the Word Swap Task ($t(30) = -2.402$, $p = 0.02$), the Wug Task ($t(30) = -2.712$, $p = 0.01$), and the Grammatical Judgement Task ($t(30) = -2.697$, $p = 0.01$). Similar to the 6- to 7-year old group, the 8-year old group did not produce significant results for the Word Manipulation task (t(30) = -1.950, p = 0.06). See figures below for comparison of means between groups. Finally, Figure 3 (below) shows the differences in means for the 8-year old group for each task by comparing the LL and TD kids.

Overall, on all tasks that produced significant results, there was a greater difference between the means of correct answers between the LL and TD children. For the tasks that did not produce significant results, the means between the two groups were more similar but the LL children still underperformed their TD counterparts.

Figure 3: 8-year old means



Study Question 2: Does a child's metalinguistic skill level correlate with age, non-verbal skills, and low-language skills?

To determine if the metalinguistic task results were related to the other tests conducted, we analyzed the correlations between the previous results and the CELF – 4 (low-language skills) score, the KBIT – 2 (nonverbal skills) scores, and the age of the child. To see a detailed description of the correlation results, refer to Table 2. To see a more detailed description of the metaprobe task results, refer to Table 3. There were significant positive correlations between the score of the child's CELF – 4 RS task, the KBIT – 2 score (KBIT – 2: $p = 0.006$, and all four metalinguistic tasks (Word Manipulation Task $p = 0.004$, Word Swap Task $p = 0.000$, Wug Task $p = 0.000$, and Grammatical Judgement Task $p = 0.029$). Age was positively and significantly correlated to all four metalinguistic tasks (Word Manipulation task: $p = 0.000$, Word Swap task: $p = 0.002$, Wug task: $p = 0.000$, and Grammatical Judgement task: $p = 0.000$).

KBIT – 2 scores were positively and significantly correlated to the CELF – 4 RS task score (p = 0.006) and the Wug task (p = 0.000).

Table 2: Correlations between

	Age	**RS Score**	**KBIT – 2 Score**	**Word Manipulation Task**	**Word Swap Task**	**Wug Task**	**Grammatical Judgement Task**
Age p-value		0.79	0.25	0.00*	0.00*	0.00*	0.00*
RS Score p-value	0.79		0.01*	0.00*	0.00*	0.00*	0.03*
KBIT – 2 Score p-value	0.25	0.00*		0.41	0.22	0.00*	0.26
Word Manipulation task p-value	0.00*	0.01*	0.41		0.00*	0.00*	0.01*
Word Swap task p-value	0.00*	0.00*	0.22	0.00*		0.00*	0.02*
Wug task p-value	0.00*	0.00*	0.00*	0.00*	0.00*		0.00*
Grammatical Judgement task p-value	0.00*	0.03*	0.26	0.01*	0.02*	0.00*	

Participant Results

Metalinguistic Task		**Age GroupAge Group**					
		4 - 5		**6 - 7**		**8**	
		LL ***n*** **= 18**	**TD** ***n*** **= 18**	**LL** ***n*** **= 27**	**TD** ***n*** **= 27**	**LL** ***n*** **= 16**	**TD** ***n*** **= 16**
Word Manipulation Task	% correct						
	Mean	74	86	97	99	97	100
	SD	24	17	7	5	5	2
	Min – Max	31 – 100	50 – 100	69 – 100	75 – 100	88 - 100	94 - 100
	p-value	0.05*		0.31		0.06	
	d	0.58		0.33		0.79	
Word Swap Task	% correct						
	Mean	44	61	58	71	59	75
	SD	21	21	18	21	15	21
	Min – Max	0 – 88	25 – 100	13 – 100	38 – 100	38 - 88	38 - 100
	p-value	0.01*		0.02*		0.02*	
	d	0.81		0.66		0.88	
Wug Task	% correct						
	Mean	17	37	30	57	47	68
	SD	14	25	23	17	23	21
	Min – Max	0 – 53	0 – 88	0 – 82	24 – 100	0 - 82	24 - 100
	p-value	< 0.00*		0.00*		0.01*	
	d	0.99		1.34		0.95	
Grammatical Judgement Task	% correct						
	Mean	47	48	57	65	62	77
	SD	20	13	9	16	15	17
	Min – Max	23 – 85	23 – 69	38 – 77	38 – 100	31 - 100	46 - 100
	p-value	0.87		0.05*		0.01*	
	d	0.06		0.62		0.94	

Table 3

Discussion

These results indicate that there are significant differences in the metalinguistic skills of children who are developing typically and those with low language abilities. Apart from one task, the Grammatical Judgement Task for the 4- to 5-year old group (LL min – max: 23-85, TD min – max: 23-69), the LL children achieved lower scores than the TD children on all tasks. These differences were supported by statistical comparisons, indicating that the children with low language abilities do have weak metalinguistic abilities. Most interestingly, the KBIT – 2 score only correlated with the Wug task, while the RS score correlated with all metalinguistic tasks as well as the KBIT – 2 score and age. This shows that nonverbal cognitive performance does not play as strong as a role in determining if a child has low language skills than verbalized language does. It was expected that nonverbal and verbal language would both play important roles for the development and execution of higher language skills, but this is not what the results indicate.

Overall, Figures 1, 2, and 3, demonstrate that the TD children outperformed their LL counterparts on all tasks in general. In conjunction with the literature reviewed earlier (Kamhi & Koenig, 1987; Liles et al., 1977; Johnson et al., 1990; Skarakis-Doyle & Dempsey, 2008), these findings match other studies conducted to compare TD and LL children: both groups improve their performance as they age, but the TD children will continually be ahead of the LL children. This study helps extend previous research by including a wider-age group as well as children who are not officially diagnosed as having a language impairment who represent a wider population of children who never receive services for their low language skills.

Limitations

One limitation of this study is the small comparison groups between kids. Ideally, more subjects could have been used to create a more robust set of data, but many children were eliminated from the possible match set due to being diagnosed with a language impairment, not finishing all/a majority of the tasks, or being too young as 3-year olds were included in a larger study conducted at the Minnesota State Fair. In addition, it is important to note that one child in the 4- to 5-year old LL group did not finish the last two metalinguistic tasks (Wug Task and Grammatical Judgement Task), one child in the 4- to 5-year old LL group did not finish the last metalinguistic task (Grammatical Judgement Task), and one child in the 6- to 7-year old LL group did not finish the last metalinguistic task (Grammatical Judgement Task). By not finishing the tasks and not receiving scores for them, these children may have skewed the data to show that the LL 4- to 5-year old group and the 6- to 7-year old LL groups did not perform as well as the equivalent TD groups.

A study with a larger sample and more greater age variation could reveal more about how LL children develop when younger and how their language develops as they age past early school years when they begin to hear and potentially exhibit more complex language. In addition, conducting studies that focus on just one age group and include other tasks that focus on just one component of his/her metalinguistic abilities could potentially reveal where and if there is an impairment. These relationships are important for better understanding typical development in children as well as signs of low language skills that could reveal a deeper language impairment, and how professionals can understand, assess, and treat the language skills of undiagnosed/low language-skilled children.

Study Conclusions

These study results reveal that overall, monolingual TD children will outperform their LL counterparts on non-verbal and verbal communication tasks as well as metalinguistic tasks. There is a strong connection between EF and the language abilities of a child. Future research should expand this study to include a greater sampling size and could also include different tasks.

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