Correlation Between Mean Length of Utterances in Preschoolers and Different Maternal Education Backgrounds

by

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Table of Contents

Abstract: The purpose of this study was to measure the mean length of utterances (MLU) in typically developing preschool children and to identify whether maternal education is an influential variable in morphological development. The study also researched the relationship between MLU and number of different words (NDW). The participants included thirteen typically developing children. The results of this study showed that there was a medium correlation between MLU and maternal education. There was a slightly weaker relationship between MLU and NDW.

Introduction

The basis for the study and calculation of morphemes comes from Roger Brown's research (1973) on diagnosing children with specific language impairment (SLI). Specific language impairment has since evolved into the term "spoken language disorder." A spoken language disorder is defined as "a significant impairment in the acquisition and use of language across modalities due to deficits in comprehension and/or production across any of the five language domains (i.e., phonology, morphology, syntax, semantics, pragmatics)" (ASHA, n. d.). Initially used to diagnose SLI in children, morpheme calculation is now widely used as a technique for speech-language pathologists to assess the development of language in children who are developing typically and children who are developing atypically. Morphemes are the smallest unit of sound with meaning in a language (Brown, 1973).

Brown's stages of development provide a framework for predicting the normal path of expressive vocabulary development in children. Mean length of utterances (MLUs) are taken by counting the number of meaningful sounds a child produces and dividing that number by the total number of utterances. Previous research indicated that MLU measurements are only accurate until around 54 months of age and then steadily become less accurate as children age (Miller & Chapman, 1981). Mean length of utterance calculation is designed to be an assessment tool for speech-language pathologists during the evaluation and diagnosis of a variety of language disorders. Early intervention is vital to the success of children overcoming a language disorder. Because some children may simply be late talkers (Leonard, 1998), speech-language pathologists

must have the tools for assessment that enable them to identify which children require intervention. Mean length of utterance calculations are one of the most valuable tools for a speech-language pathologist.

Previous research has highlighted numerous variables that could affect language production. The variables studied previously have included SES, IQ, and the presence of SLI (Rice, Redmond, & Hoffman, 2006). The results of a study by Walker et al. (1994) showed that language samples of children aged 7 to 36 months varied based on socioeconomic status, along with measured IQ. Similarly, this study will analyze SES as an influential variable, but with older children (36 to 60 months old).

There is extensive research surrounding the use of MLUs as a way of identifying typical language development, as well as establishing developmental milestones for children. Initially, MLU scores were used as an indicator of the presence of language impairments. In more recent years, researchers have started to turn their focus to the factors that can influence morphological development. However, the field of research is sorely lacking information about how parental education level can affect children's language development as measured by MLUs.

Mean length of utterance measures began out of a study by R. W. Brown. Written in 1973, Brown's book is the first to identify and define the syntactical rules of language as it is acquired at each stage of development. Brown studied how three children (aged 1 to 2 ½) developed language, specifically morphologically. He then measured their morphological development by counting their utterances and determining levels of development based on age. He divided language development into five chronological stages, each with a corresponding mean length of utterance (MLU). This became the

basis for determining how well children were developing language from birth. MLUs are taken by counting the number of meaningful sounds a child produces and dividing that number by the total number of utterances. MLUs were first utilized as a tool for identifying language impairments in children by using spontaneous language samples and aligning them with age referent standards.

Written by Laurence Leonard, *Children With Specific Language Impairment* (SLI) explains the logic behind using MLU measurements to identify specific language impairment in children. Leonard (1998) specifically discusses how MLU can be used to age match control groups with groups of children with SLI (p. 28). For example, the first age-matching study performed in 1973 matched SLI children of ages 5 to 8 with a control group of children aged 20 months to 3 years. A comparison group is necessary for analyzing the results of children with SLI because children with SLI typically struggle more with comprehension than with production (p. 29). Using MLU measurements ensures that researchers are truly identifying functional differences. This highlights how MLU can serve as indicator for language impairments.

A review written by Eisenberg, Fersko, and Lundgren (2001) compiled previous research done to identify language impairments in preschool children. Researchers were motivated by the field's lack of "formal or standardized procedures" (p. 339) for analyzing MLU from language samples. It can be difficult for clinicians to understand the value of the measure when there is no manual for data collection. The results of the two studies involved two different populations. It has been suggested that MLU measurements are only accurate until around 54 months of age and then steadily become less accurate as children age (p. 325). Because of this, both studies selected possessed

populations of children 60 months or younger. By analyzing results from both populations, the authors determined MLU scores to be 96% accurate when identifying children with a language impairment. MLU computation was determined by the authors to be *a* way to identify impairments, but not necessarily the only or best way (p. 338). While a low MLU can be interpreted to mean a language impairment is present, MLU scores above the predetermined lower cutoff cannot be guaranteed to rule out the presence of a language impairment.

"Prevalence of Specific Language Impairment In Kindergarten Children" (Tomblin, Records, Buckwalter, Xuyang, Smith, & O'Brien, 1997) studied the prevalence of SLI in samples of kindergarten children from urban, rural, and suburban areas of the American Midwest. Researchers discovered during the study that there was little information regarding the prevalence of SLI in American children. It was necessary for researchers to establish the exclusionary conditions for SLI, which include autism, neuromotor impairments, and persistent hearing loss. These conditions were generally agreed upon in previous research, but inclusionary conditions proved more difficult to establish. As of this study, current inclusionary conditions are determined by chronological age referencing instead of past conditions decided by the scores of nonverbal IQ. Researchers used two tests to screen participants for SLI. First, participants were administered excerpts from the Test of Language Development (TOLD-2:P). The children who failed this test were then recruited for a more comprehensive diagnostic battery of SLI testing. This battery included hearing, language, speech, and nonverbal IQ components. The results of the study determined that 7.4% of participants (M=7,844) were diagnosed with SLI. In terms of prevalence by gender, 6% were female and 8%

were male. In terms of prevalence by race, Native American and African American children presented with the most diagnoses of SLI. None of the 70 Asian American children were diagnosed with SLI. The significance of this study can be seen in the establishment of parameters for exclusionary and inclusionary conditions relevant to diagnosis.

Rice, Richmond, and Hoffman (2006) conducted two concurrent studies in an attempt to answer unresolved questions regarding the validity of using MLUs as a basis for language impairments. Study 1 examined concurrent studies of five-year-old children with language impairments and typically developing three-year-old children. The purpose of this study was to identify any differences between groups on MLU scores. Study 2 examined MLU score stability over the course of five years. Its purpose was to identify, if any, the change in rates of growth over time. It also compared the growth of MLUs to growth of vocabulary. Study 2 also addressed the question, "Does mother's education or children's nonverbal intelligence predict growth in MLU, and, if so, does the prediction vary by group?" p. 798). For Study 1, conversational samples taken from a previous study were analyzed using SALT and KLTD. Results showed that of three groups, the age-equivalent group had higher scores than the MLU or SLI-equivalent groups. Results also showed that the MLU-equivalent and SLI-equivalent groups produced similar MLU scores. Because age and MLU did not have a strong correlation in this study, it may be that correlation is stronger in younger children (2;0 to 4;2). Previous conversational samples were again used for Study 2. Results indicated that MLU had strong stability across a five-year period. Overall results indicated that MLUs of children with language impairments are equivalent to the MLUs of typical children two years older. The

longitudinal study over five years provided strong evidence that MLU remains a valid and stable indicator for language development, both typical and atypical.

A study performed by Rice, Smolik, Perpich, Thompson, Rytting, and Blossom ("Mean Length of Utterance Levels in 6-month Intervals for Children 3 to 9 Years With and Without Language Impairments") used MLU data to compare children with and without language impairments within a specific age range. The authors highlight an important problem for MLU data in the fact that the children with SLI included a high percentage of speech impairment diagnoses. This could be problematic in the sense that MLU samples could yield low intelligibility. The purpose of this study was to report MLU measures for children aged 3 to 9 with and without language impairments. This study reinforces the results of the study by Tomblin, Records, Buckwalter, Xuyang, Smith, and O'Brien (1997) because it follows the procedure of using chronological age referencing as opposed to fluctuating exclusionary conditions. This study took into account maternal education level, with most participants reporting maternal education as high school graduate level. While it was more challenging to collect intelligible MLU samples for language impaired children younger than 4 years of age, researchers were able to record intelligible samples for each participant, regardless of the presence of a language impairment. Results from each 6-month interval indicate that while children without language impairments consistently had higher MLUs, even the children with language impairments increased their MLUs by at least .25 over time. The results showed an insignificant association between maternal education levels and MLUs for all groups but unaffected children between the ages of 5;0 and 6;11. The results showed a

correlation between unaffected children 5;0-6;11 with less-educated mothers and a higher MLU. No advantage was discovered for children with mothers of higher education levels.

"Maternal Education and Measures of Early Speech and Language" (Dollaghan et al., 1999) studied how maternal education could affect four measures of speech, including MLU, number of different words (NDW), total number of words (TNW), and percentage of consonants correct (PCC). Because these tests were all based on spontaneous language samples, the Peabody Picture Vocabulary Test-Revised (PPVT-R) was also included as a norm-referenced test for comparison. Three levels of maternal education were included in the study: less than high school graduate, high school graduate, and college graduate. The 240 three-year old participants were from various geographic settings but were not separated by setting during the study. Results showed a direct correlation between maternal education level and mean length of utterance in morphemes. Mean scores for MLU increased as maternal education increased, with a mean MLU of 2.73 for children of mothers with less than a high school diploma jumping to 3.29 for children with mothers who were college graduates. Children with mothers who had a higher education level also had larger mean NDW and TNW scores. PPVT-R results also showed increased scores for children with mothers who had completed college. It is important to note that while the participants were from three different settings in Pittsburgh, the differences in these settings were not taken into account. The scores of the children from urban, suburban, and rural settings were all analyzed only by maternal education level.

A study by Dethorne, Johnson, and Loeb (2004) explored how morphosyntax and semantics were related to MLU. Researchers considered MLU to be significant because it

is “a frequently used measure of expressive language ability within both clinical and research settings” (p. 635). The study only followed typically developing children that were from a two-parent home in which one or both parents had completed college and held a white-collar job. In terms of racial diversity, 40 of the 44 participants were white. The results of this study indicated that, based on previous research, each of the participants had an average MLU typical of their age (p. 639). The results also allowed authors to predict MLU at 28 months by analyzing total vocabulary at 20 months. This information provides a connection between expressive vocabulary and MLU. This study concludes by informing readers that further research with different populations is required to ensure an accurate correlation between vocabulary and predictions of future MLUs. Because research on the MLUs of typically developing children is more limited, the present study is particularly useful. It serves as a reference for comparison when studying children with language impairments. However, the impact of this research on influential variables is limited, considering that the population was solely composed of children with parents who had completed college and held white-collar jobs.

It is evident within this body of research that most studies have concentrated their efforts on studying children with language impairments. Within the studies of typically developing children, there is little research dedicated to how variables like SES and maternal education level affect MLU development. Most studies used typically developing children as a contributor to the norm referenced samples used for comparing the results of children with language impairments. If the researchers documented the geographic locations of their studies’ participants, rarely was it taken into account. The current research indicates that researchers should shape their future studies about typical

children in the direction of maternal education and geographic location as influences on MLU scores. This gap in research leads to the question: Does maternal education level affect the length of the utterances children produce, particularly preschoolers?

Purpose

The purpose of this study is to measure the mean length of utterances in typically developing preschool children and to identify whether maternal education is an influential variable in morphological development. Maternal education level will be used as a proxy for SES because education has been suggested to be a more accurate indicator of social position than yearly income (Fannin, Barbarin, & Crais, 2018). The data will be derived from play-based language samples and results will allow future researchers to improve upon early intervention for clients at a critical period of development.

Research questions

1. Will preschooler language samples show a correlation between MLU and maternal education?
2. Will there be a correlation between NDW scores and MLUs?

Hypothesis

Based on previous research by Walker et al. (1994), the researcher predicted that children from lower income homes (as determined by maternal education) will have fewer utterances on average than children from higher income homes. The researcher also predicted that preschoolers with higher NDW scores will have longer MLUs.

Methods

Inclusionary Criteria

To ensure that the participants have normal cognition, language and hearing the following inclusionary criteria had to be met for each participant, which was normal performance on the Primary Test of Nonverbal Intelligence (Ehrler & McGhee, 2008; PTONI), Oral and Written Language Scales- 2 (Carrow-Woolfolk, 1995; OWLS) and passing a hearing screening. These tests were performed during each participant's first visit. Each participant was required to have a standard score of 85 or above on both the PTONI and OWLS tests and pass a pure tone hearing screening in order to continue in the study. To avoid order influence, the two tests were alternated for each participant**.**

Participants

Fifteen children were recruited to participate in the study. Children were recruited from preschools in Middle Tennessee counties. To participate in the study, each participant had to be typically developing in the area of language, nonverbal cognitive abilities and hearing. This was assessed using standardized measures. Additional assessments included a speech intelligibility assessment. Each participants' parent was asked to fill out a demographic questionnaire. See Appendix B.

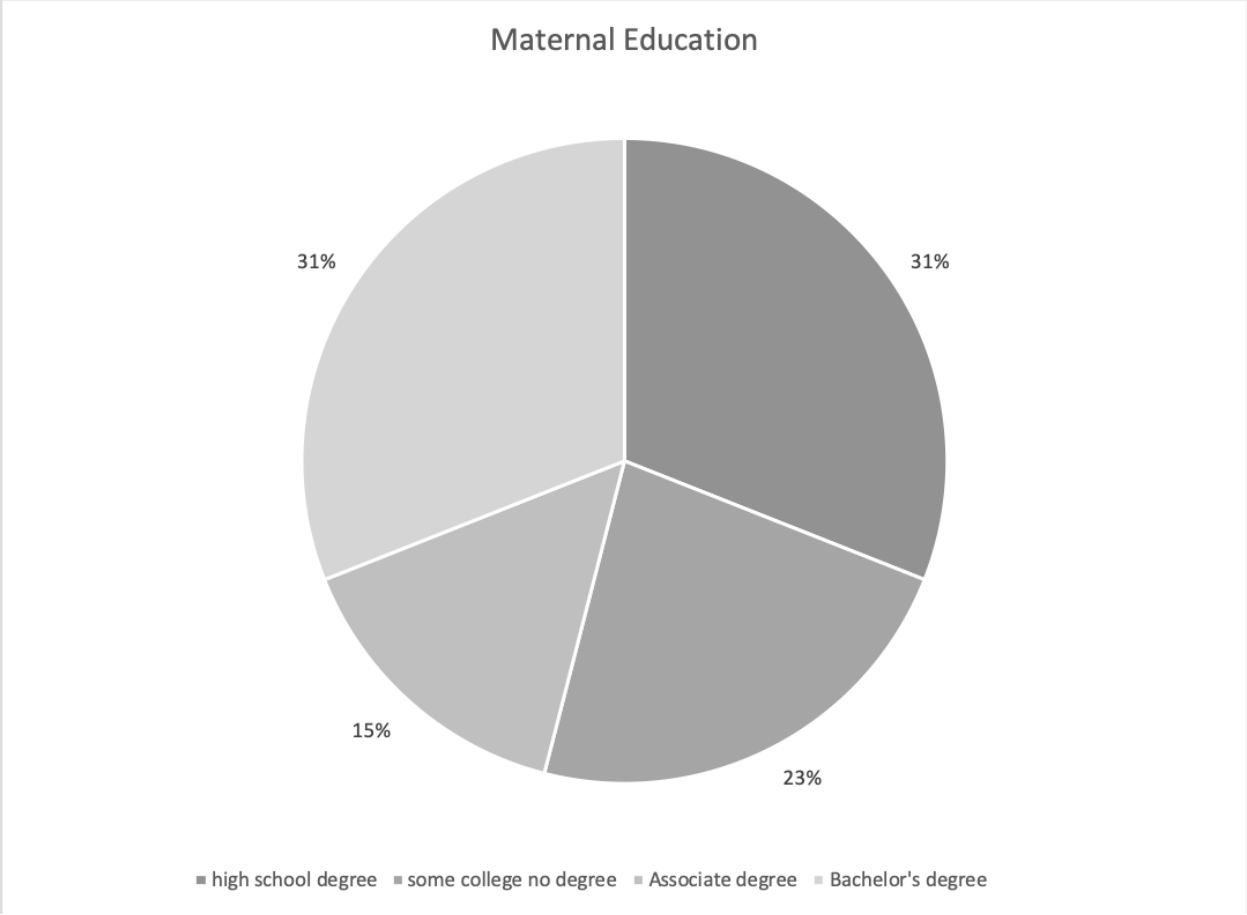
Of those 15, two children were excluded because they could not meet a basal score on either the PTONI or the OWLS; therefore, they were not asked to continue further. The study included 13 children (7 boys and 6 girls). The participants ranged in age from 39 months to 68 months with a mean age of 52.7 months. 76.9% of participants were Caucasian and 23.1% were African American. Researchers administered each of the three standardized tests across two testing sessions in addition to the language sample to

ensure that each participant had normal intelligence, speech and language skills. Each participant received a standard score for the PTONI and GFTA-2. For the OWLS, participants received a standard score for two subtests and a composite score.

Free and reduced lunch programs assisted in recruiting children from lower SES backgrounds and private preschool programs assisted in recruiting children from middle to high SES backgrounds. The maternal education level of each preschoolers was used to determine final SES status, which was documented with a questionnaire detailing levels of education (e.g., less than high school degree, high school degree only, etc.; Rice, Smolik, Perpich, Thompson, Rytting, & Blossom, 2010). See Appendix B for the questionnaire.

Maternal education levels were divided into five groups, which are as follows: some high school, no degree; high school degree; and some college, no degree; associate degree or higher. Mothers of 30.8% of participants reported having a high school degree, 23.1% of participants' mothers reported having some college without a degree, 15.4% of participants had a mother who reported having an associate degree, and 30.8% of participants reported having a bachelor's degree. See Graph 1.

Graph 1: Maternal Education of Participants



Testing Procedures

Each participant attended two testing sessions that lasted approximately 1-hour each. During the first visit, each participants' nonverbal intelligence, receptive and expressive language skills and hearing status were evaluated to determine their inclusion in the study. The PTONI test is a nonverbal intelligence test that analyzes a child's general intelligence (Ehrler & McGhee, 2008). The test takes about 15-mintues to complete on average. The OWLS-2 test is designed to evaluate receptive and expressive oral language skills and ensure that participants do not present with a language

impairment (Carrow-Woolfolk, 1995). The Listening Comprehension and Oral Expression subtests assess receptive and expressive language, respectively (Carrow-Woolfolk, 1995). The test takes approximately 30 minutes to complete. The hearing screening was a pure tone audiometry assessment. It tested each participant's hearing at 20 dB HL (at 1,000, 2,000, and 4,000 Hz). In order to obtain hearing assessment results, researchers used Conditioned Play Audiometry (CPA), designed for children between the ages of 2 and 5 (ASHA, n. d.). Conditioned play involved asking the child to place a toy in a box (or similar action) when he hears a sound. (ASHA, n. d.). Those potential participants who do not meet the conditions of typically developing children and normal hearing were not be asked to participate further.

During the second visit, each participant's receptive vocabulary and articulation were evaluated. Additionally, a play-based language sample was taken. To assess speech intelligibility, the Goldman Fristoe Test of Articulation 3 was administered (Goldman & Fristoe, 2015; GFTA-3). The purpose of the GFTA-3 is to rank speech intelligibility (Goldman & Fristoe, 2015). See Table 1 for participant demographics on each of the inclusionary criteria.

Table 1: Participant Demographics

Standardized Measures	Mean (St Dev)
OWLS Composite	111.9 (6.3)
OWLS LS	113.1 (4.8)
OWLS OE	112.1 (8.0)
PTONI	117.5 (8.7)
GFTA-2	116.2 (3.7)
MLU	4.5 (1.0)
NDW	102.8 (21.3)

Play-based Language Sample Procedure

A language sample was elicited from each participant during a play-based conversation with the researcher. Samples were taken in a quiet room that resembled a classroom setting. The researcher presented each child with a set of play materials. Toys of appropriate age were utilized to initiate play. These toys included toy people, pretend

household objects, toy animals and other toys deemed age-appropriate (Rice, Redmond, & Hoffman, 2006). The researcher began collecting each language sample by engaging the child in conversation with familiar materials.

Research has shown that children at age three can direct their attention to a preferential activity for 33 minutes and children at age five can maintain attention for 35 minutes (Moyer & von Haller Gilmer, 1954). The researcher remained aware of the participants' attention span and monitored engagement. This required researchers to limit testing to 30 to 35-minute intervals and offer the child a 5 to 10-minute break during a testing session. The samples were audio-recorded by the primary researchers. Each sample was at least 15 minutes in length. The samples were recorded using a Philips Voice Tracer Digital Recorder, DVT8000. The children were each awarded with a small prize pack (book, crayons, bubbles, etc.) for participating.

MLU Calculation

Language samples were transcribed according to SALT (systematic analysis of language transcripts) conventions for computerized language sample analysis. Samples collected were at least 100 utterances in length and mostly intelligible. The language samples were examples of each child's functional, naturally spoken language. The SALT program allowed researchers to use the database to compare each child to the other participants. It provided researchers with a mean length of utterances (MLUs) calculation in both morphemes and words. Additionally, researchers recorded the number of different words (NDW) for each sample.

Analysis

From the audio recording, the utterances were transcribed into Microsoft Word. Transcriptions were then copied into the SALT software program. The SALT program calculated the MLU in morphemes, t-units, and NDW. Statistical analysis was performed to determine if any differences existed between children from high/middle SES and low SES and MLU and children with high NDW scores and low NDW scores and MLU.

Correlation statistics were calculated to determine the relationship between MLU and education level. Correlation statistics were checked for validity within the Pearson Correlation Coefficient Calculator. The correlation coefficient is the linear relationship between two correlates. It is represented by *r*. A large positive correlation is determined by Pearson Correlation Coefficient Calculator to be anything between .5 and 1.0 (Laerd Statistics, n.d.). A medium correlation is any r-value between .3 and .5. A level of significance was set at $p<0.5$.

Transcription and Coding

Each participant's sample was transcribed and coded. All transcriptions were performed by the primary researcher. During transcription, the participant's utterances were transcribed verbatim from the participant's recording. Transcriptions were coded for bound morphemes and mazes. A bound morpheme is one that cannot stand alone; it can only be present as part of a larger unit (R.I.T., n.d.). Mazes are nonfluencies like filled pauses, repetitions, and abandoned utterances (R.I.T., n.d.).

Reliability

To achieve reliability, a research assistant was recruited to complete reliability checks on both the standardized tests and the language samples. The research assistant received copies of the standardized test scores and checked them for accuracy. The

assistant also received the audio files of language samples and the corresponding transcriptions. She checked the transcription accuracy and coding. The research assistant checked 77% of both the standardized tests and language sample transcriptions. The primary researcher and assistant came to an 81% interrater reliability score. When disagreements occurred, the primary researcher and research assistant met to discuss them. All disagreements were resolved and agreement was achieved.

Results

The current study sought to determine whether maternal education would affect mean length of utterance (MLU). The current study also sought to determine the correlation between mean length of utterance and number of different words (NDW). Descriptive and correlational statistical analyses were conducted through the SPSS Statistics software program.

The first research question stated, "Will preschooler language samples show a correlation between MLU and maternal education?" It was hypothesized that preschoolers with mothers with little or no education will have shorter MLUs when compared to the MLUs of peers with more highly educated mothers. To answer the first research question, the mean MLU was calculated for both groups using a language sample. The mean MLU for the participants was 4.5 with a standard deviation of 1.0. The correlation between MLU and maternal education by group was $r = .442$, $p=.13$, which is not statistically significant. However, this is considered to be a medium positive correlation. The results suggest that as maternal education increased (e.g., mother's with higher levels of education) so did the length of MLU in the participants such that the participants from higher maternal education families had longer MLUs.

The second research question stated, "Will there be a correlation between NDW scores and MLUs?" To answer this question, correlational statistics evaluated the relationship between MLU and NDW. The mean NDW for the participants was 102.8 with a standard deviation of 21.3. The Pearson correlation between MLU and NDW was $r = .474$, $p= .1$, which was not statistically significant. However, this is considered to be a

medium positive correlation. The results suggest that there is a relationship between NDW and MLU such that as the participants who had larger NDW had longer MLU.

Discussion

The current study aimed to identify the relationship between MLU and maternal education levels. It also sought to identify the relationship between MLU and NDW. The correlative results indicate that there is a medium correlation between both MLU and maternal education level and NDW and MLU that did not reach significance. The researcher believes that the correlation would have been stronger if the sample size was larger. However, the medium correlation still reinforces previous research about the relationship between MLU and maternal education, as well as between MLU and NDW.

One study conducted by Rice, Richmond, and Hoffman (2006) sought to determine the correlation between MLU and vocabulary as age increased. Their results showed a decreasing correlation between MLU and vocabulary as age increased. The current study's results showed a medium correlation between MLU and NDW (as a measure of vocabulary). This could be contributed to the age range of the participants. The results of the current study are trending to support Rice et al.'s findings of the decreasing relationship between MLU and vocabulary. It could be that a child's actual vocabulary does not affect his or her MLU as much as the language the child is exposed to in his or her family. It could be speculated that individuals from families with higher maternal education experience more complex language on diverse topics compared to children from lower maternal education families. Likewise, children from families with higher maternal education might also have more diverse experiences. For example, going

to the beach, flying on a plane, or going to the zoo, are all experiences that could enhance a child's overall ability to engage in conversations about those experiences.

The researcher was interested in the impact of varying maternal education on MLU of preschoolers. Therefore, descriptive analysis was conducted to further investigate the relationship between maternal education and MLU by dividing the participants into two groups (i.e., high education and low education). See Table 2. Results indicate that the mean MLU for the higher education group was greater than the lower education group. After conducting an independent t-test, results for the two groups were not statistically significant. This could be contributed, in part, to the small group size.

Table 2: High and Low Ed Groups

Group	Mean (St Dev)
High Ed's MLU	4.9 (1.0)
Low Ed's MLU	4.1 (0.9)
High Ed's NDW	102.2 (26.3)
Low Ed's NDW	103.3 (18.3)

Additionally, NDW had the largest degree of variability with a standard deviation of 21.3. Descriptive analysis also indicated a higher degree of variability for the group of high education participants when compared to the group of low education participants. Refer to Table 2. This could also be contributed to a small sample size. It could also be that each participant has significantly different levels of exposure to increasingly

complex vocabulary. Some children, regardless of their maternal education, may have had more or less exposure to vocabulary based on individual experience. This could contribute to the high degree of variability.

Researchers were interested in the potential relationships between the descriptive variables. After analyzing the results pertaining to the research questions, several post hoc analyses were performed. The mean and standard deviation were calculated for the following seven variables: OWLS listening comprehension subtest standard score, OWLS oral expression subtest standard score, OWLS composite score, PTONI standard score, GFTA-2 standard score, MLU and NDW. See Table 1.

After evaluating the descriptive statistics, correlative statistics were run to identify a relationship between maternal education and IQ, as well as between oral language and MLU. Researchers broke the participants into two groups based on high or low maternal education. Researchers were interested in the potential relationship between IQ and maternal education. Researchers were also interested in the relationship between oral language and MLU. Results of the correlation between the PTONI standard scores (used as a measure of intelligence) and maternal education show a correlation of $r = .446$, $p= .1$This is a medium correlation. Research performed by Walker et al. (1994) concluded that IQ varied by maternal education, similarly to MLU. The results of this study reinforce those findings. The medium correlation between PTONI scores and maternal education indicates that maternal education has an impact on IQ.

By using the OWLS composite scores as a measure of oral language, researchers ran a correlation analysis with MLU. Interestingly, there was a smaller correlation between oral language and MLU. Researchers expected a high correlation between the

two variables. The results of the relationship between the OWLS composite scores and maternal education showed a correlation of r = .279, p= .3. The small correlation was surprising to researchers, considering that MLU is an indicator of the complexity of oral language, especially at a young age.

Clinical Implications

The results from this study could be used clinically as an aid for both educators and speech language pathologists. Because maternal education had a medium correlation with MLU, it has at least a partial impact on language development. It is important for educators to know that children from families of different education levels might have different linguistic abilities. Speech language pathologists are responsible for providing the earliest intervention services possible to vulnerable populations. Knowing that children of mothers with a lower education level are at risk for lower language abilities will allow speech language pathologists to develop interventions that are appropriate to each child's needs. Speech language pathologists should consider obtaining parental education information when collecting initial background information from new clients. Furthermore, this knowledge could aid speech language pathologists as they determine how to educate parents. This could involve sharing resources with parents and encouraging parents to incorporate literacy skills into their daily routine. Additionally, language samples are often used by speech language pathologists for assessing clients' language abilities and knowing that MLU is impacted by maternal education could impact how speech pathologists interpret language sample results.

Limitations

There are several limitations to this study. First, the sample size (n=13) was small. For results to be statistically significant, the sample size would have needed to be much larger. Second, even though they were given breaks during the testing sessions, the participants (especially the younger ones) grew tired quickly. It is possible that some participants may have performed better on the standardized tests if the tests were administered with more breaks or in fewer sessions. Furthermore, although parents were allowed in the testing session if necessary, some participants became less cooperative with their parents present. This could have also impacted results.

Conclusion

The results of this study revealed a medium correlation between maternal education and MLU. This indicates that maternal education does have an impact on MLU, which supports previous research. The results also revealed a medium correlation between MLU and NDW. Because previous research revealed that the relationship between MLU and vocabulary decreases with age, the current study's correlation could have been statistically significant with younger children. Post hoc analysis showed a medium correlation between intelligence scores and maternal education. It also showed a small correlation between oral language scores and MLU.

This research was preliminary and further testing should be conducted. Future researchers should continue to study the initial two research questions but improve on methodology by significantly increasing the participant sample size.

References

American Speech-Language-Hearing Association. (n. d.). Identifying children with specific language impairment. Retrieved 2019, from https://academy.pubs.asha.org/2013/11/identifying-children-with-specific-language-impairment/.

American Speech-Language-Hearing Association. (n. d.). Spoken language disorders. Retrieved 2019, from https://www.asha.org/practice-portal/clinical-topics/spoken-language-disorders/.

Brown, R. W. (1973). *A First Language: The early stages*. Cambridge, Mass.: Harvard University Press.

Carrow-Woolfolk E. (2015). OWLS Listening Comprehension and Oral Expression Scale-Second Edition. Circle Pines, MN: American Guidance Service.

Dethorne L. S., Johnson B. W., & Loeb J. W. (2005). A closer look at MLU: what does it really measure? *Clinical Linguistics & Phonetics, 19*(8), 635–648. Retrieved from https://ezproxy.mtsu.edu/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=ccm&AN=106372756&site=eds-live&scope=site.

Dollaghan, C. A., Campbell, T. F., Paradise, J. L., Feldman, H. M., Janosky, J. E., Pitcairn, D. N., & Kurs-Lasky, M. (1999). Maternal education and measures of early speech and language. *Journal of Speech, Language & Hearing Research, 42(*6), 1432. Retrieved from https://ezproxy.mtsu.edu/login?url=http://search.ebscohost.com/login.aspx?.

Eisenberg, S. L., Fersko, T. M., & Lundgren, C. (2001). Clinical consult. The use of MLU for identifying language impairment in preschool children: a review. *American Journal of Speech-Language Pathology, 10*(4), 323–342. Retrieved from https://ezproxy.mtsu.edu/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=ccm&AN=106919700&site=ehost-live&scope=site.

Ehrler D., & McGhee R. (2008). Primary Test of Nonverbal Intelligence. Austin, TX: Pro-Ed.

Goldman R., & Fristoe M. (2015). Goldman-Fristoe Test of Articulation–Third Edition. San Antonio, TX: Pearson.

Hadley, P. A., Rispoli, M., Fitzgerald, C., & Bahnsen, A. (2011). Predictors of morphosyntactic growth in typically developing toddlers: Contributions of parent input and child sex. *Journal of Speech, Language & Hearing Research, 54*(2), 549–566. Retrieved from https://doi-org.ezproxy.mtsu.edu/1092-4388(2010/09-0216).

Kenneth E. Moyer, & B. von Haller Gilmer. (1954). The Concept of Attention Spans in Children. The Elementary School Journal, 54(8), 464. Retrieved from https://ezproxy.mtsu.edu/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=edsjsr&AN=edsjsr.998982&site=eds-live&scope=site

Laerd Statistics. (n.d.). Pearson Product-Moment Correlation. Retrieved from https://statistics.laerd.com/statistical-guides/pearson-correlation-coefficient-statistical-guide.php.

Leonard, L. B. (1998). *Children with specific language impairment.* Cambridge, Mass.: The MIT Press.

Rice, M. L., Redmond, S. M., & Hoffman, L. (2006). Mean length of utterance in children with specific language impairment and in younger control children shows concurrent validity and stable and parallel growth trajectories. *Journal of Speech, Language & Hearing Research, 49*(4), 793–808. https://doi-org.ezproxy.mtsu.edu/10.1044/1092-4388(2006/056).

Rice, M. L., Smolik, F., Perpich, D., Thompson, T., Rytting, N., & Blossom, M. (2010). Mean length of utterance levels in 6-month intervals for children 3 to 9 years with and without language impairments. *Journal of Speech, Language & Hearing Research, 53*(2), 333–349. https://doi.org/1092-4388(2009/08-0183)

R.I.T (n.d.). What are Morphemes?. Retrieved from https://www.ntid.rit.edu/sea/processes/wordknowledge/grammatical/whatare.

Tomblin, J. B., Records, N. L., Buckwalter, P., Xuyang Zhang, Smith, E., & O'Brien, M. (1997). Prevalence of specific language impairment in kindergarten children. *Journal of Speech, Language & Hearing Research, 40*(6), 1245. Retrieved from https://ezproxy.mtsu.edu/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=asn&AN=11792&site=ehost-live&scope=site.

Walker, D., Greenwood, C., Hart, B., & Carta, J. (1994). Prediction of school outcomes based on early language production and socioeconomic factors. *Child Development, 65*(2), 606-621. Retrieved from https://doi-org.ezproxy.mtsu.edu/10.2307/1131404.

Appendices

Appendix A

Language Sample Protocol

Play/Conversation Sample (Younger Child)

Hi. I'm Lilli.

What's your name.
(child's name) how old are you?
Do you have any brothers or sisters?
(if they do have siblings) What kinds of things do you like to do with your brother or sister?
I've brought x for us to play with!
What should we do with it?

Play/Conversation/Narrative Sample (Older Child)

Hi. I'm Lilli.
What's your name.
(child's name) how old are you?
Do you have any brothers or sisters?
(if they do have siblings) What kinds of things do you like to do with your brother or sister?
Tell me about what you've been doing at school!
What is your favorite part of school?
Are you excited about summer?
What are you doing for fun?
Do you have any pets at home?
Who lives at your house?
Do you go to the movies?
Tell me about the last movie you saw.
What happened?
I've brought x for us to play with!
What should we do with it?

Toy List

Farm animals: cows, horse, pig + babies, duck, chicken, dog
Firetruck with firewoman
Action figures (boy, girl, mom, dad)
Toy cars
Kitchen set: pretend food, skillet, spatula, spoon
Recycling truck
Doctor kit: thermometer, syringe, blood pressure cuff, fever chart, otoscope

Appendix B

Demographic Questionnaire

Your name: Telephone number:

Email address: Child's name:

Child's age: Child's birthday:

School attended:

Mother: What is your highest education level?

_____ Less than high school diploma
_____ High school diploma or equivalent
_____ Some college, no degree
_____ Associates degree
_____Bachelor's degree
_____ Master's degree/Professional Degree

Father: What is your highest education level?

_____ Less than high school diploma
_____ High school diploma or equivalent
_____ Some college, no degree
_____ Associate's degree
_____Bachelor's degree
_____ Master's degree/Professional Degree

Appendix C

IRB
INSTITUTIONAL REVIEW BOARD
Office of Research Compliance,
010A Sam Ingram Building,
2269 Middle Tennessee Blvd
Murfreesboro, TN 37129

MIDDLE TENNESSEE STATE UNIVERSITY

IRBN001 - EXPEDITED PROTOCOL APPROVAL NOTICE

Thursday, April 18, 2019

Principal Investigator	**Lillian Beck** (Student)
Faculty Advisor	Kathryn Blankenship
Co-Investigators	NONE
Investigator Email(s)	lb5z@mtmail.mtsu.edu; kathryn.blankenship@mtsu.edu
Department	Speech-Language Pathology & Audiology, Health Science
Protocol Title	***Correlation between mean length of utterances in preschoolers and different maternal education backgrounds***
Protocol ID	**19-2199**

Dear Investigator(s),

The above identified research proposal has been reviewed by the MTSU Institutional Review Board (IRB) through the **EXPEDITED** mechanism under 45 CFR 46.110 and 21 CFR 56.110 within the category *(7) Research on individual or group characteristics or behavior.* A summary of the IRB action and other particulars in regard to this protocol application is tabulated below:

IRB Action	**APPROVED for ONE YEAR**		
Date of Expiration	**4/30/2020**	Date of Approval	4/18/19
Sample Size	100 (ONE HUNDRED)		
Participant Pool	Primary Classification: **Special Population - Minors (3-5 years of age)** Specific Classification: **Students of Baker Elementary School and First United Methodist Weekday School**		
Exceptions	1. Verbal assent is permitted when applicable. 2. Voice data of the participant are permitted. 3. Contact information including identification number is permitted.		
Restrictions	**1. Mandatory signed parental consent and active child assent; the participants must have access to an official copy of the informed consent document signed by the PI.** **2. Data must be deidentified once processed.** **3. Identifiable data must be destroyed as described in the protocol.** **4. Any identifiable data/artifacts that include auido/video data, photographs and handwriting samples must be used only for research purpose and must be destroyed after data processing.**		
Comments	NONE		

This protocol can be continued for up to THREE years (**4/30/2022**) by obtaining a continuation approval prior to **4/30/2020**. Refer to the following schedule to plan your annual project reports and be aware that you may not receive a separate reminder to complete your continuing reviews. Failure in obtaining an approval for continuation will automatically result in cancellation of this

protocol. Moreover, the completion of this study MUST be notified to the Office of Compliance by filing a final report in order to close-out the protocol.

Post-approval Actions

The investigator(s) indicated in this notification should read and abide by all of the post-approval conditions imposed with this approval. Refer to the post-approval guidelines posted in the MTSU IRB's website. Any unanticipated harms to participants or adverse events must be reported to the Office of Compliance at (615) 494-8918 within 48 hours of the incident. Amendments to this protocol must be approved by the IRB. Inclusion of new researchers must also be approved by the Office of Compliance before they begin to work on the project.

Continuing Review (**Follow the Schedule Below:**)

Submit an annual report to request continuing review by the deadline indicated below and please be aware that **REMINDERS WILL NOT BE SENT.**

Reporting Period	Requisition Deadline	IRB Comments
First year report	3/31/2020	The PI requested to end the protocol by December, 2019. If not renewed, this protocol will automatically close on the date mentioned in page 1.
Second year report	3/31/2021	NOT COMPLETED
Final report	3/31/2022	NOT COMPLETED

Post-approval Protocol Amendments:

Only two procedural amendment requests will be entertained per year. *In addition, the researchers can request amendments during continuing review. This amendment restriction does not apply to minor changes such as language usage and addition/removal of research personnel. .*

Date	Amendment(s)	IRB Comments
NONE	NONE.	NONE

Other Post-approval Actions:

Date	IRB Action(s)	IRB Comments
NONE	NONE.	NONE

Mandatory Data Storage Requirement: All of the research-related records, which include signed consent forms, investigator information and other documents related to the study, must be retained by the PI or the faculty advisor (if the PI is a student) at the secure location mentioned in the protocol application. The data storage must be maintained for at least three (3) years after study has been closed. Subsequent to closing the protocol, the researcher may destroy the data in a manner that maintains confidentiality and anonymity.

IRB reserves the right to modify, change or cancel the terms of this letter without prior notice. Be advised that IRB also reserves the right to inspect or audit your records if needed.

Sincerely,

Institutional Review Board
Middle Tennessee State University