

# Counting MLU in morphemes and MLU in words in a normally developing child and child with a language disorder: A comparative study

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*This paper provides a detailed description of Mean Length of Utterance (MLU) including a research experiment with a view to getting a comparative result on counting MLUm and MLUw—two specialized versions of MLU. In this experiment the data of a normally developing child and a child with language disorder have been taken from CHILDES database. The result which is relevant to some other previous studies shows that there exists a strong correlation between MLUm and MLUw. Thus, as a means of calculating MLU, MLUw could be preferred because it is easier, less technical in terms of grammatical complexity as well as a language or dialect neutral procedure.*

**Key words:** Mean Length of Utterance, MLUm, MLUw, CHILDES, SLI, CLAN

Over the last hundred years different types of procedures for measuring the length of utterance in the spontaneous speech of children have been used all over the world. These mainly try to uncover the nature and characteristics of children's language development especially their word and utterance length, details of morpheme counting, syntactic complexity, and grammatical authenticity in both research and clinical setting. In addition, these procedures also exhibit some comparative aspects of morphosyntactic development between normally developing children and children with language disorders. Of all the procedures, Mean Length Utterance (MLU) is considered as a very effective and popular technique in this regard.

Mean Length of Utterance or MLU is a reliable tool to indicate the nature of morphosyntactic development of children. It tries to measure a mode of expressive language ability to both normally developing children and children with language disorders because the MLU of normally developing children indicates necessary information concerning various grammatical difficulties of children with language problems. MLU has been a global measure-technique for morphosyntactic development and it is widely used in the domain of child-

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language frequently. Hence, many linguists, clinicians, speech pathologists are now applying MLU in their working field as well as research activities all over the world. In the following there are some important definition-statements including the basic characteristics of MLU developed in the literature of child-language acquisition and process over time.

Miller (1991) emphasized that Mean Length of Utterance is the most widely accepted general measure of language development in young children. According to Klee (1992) MLU is widely used as a measure of children's developing language by researchers studying both normal development and language impaired. Johnston (2001) states that MLU has been the most commonly used index of development for spontaneous language sample data. Bol (2003) depicted that MLU is used to indicate children's productive grammatical complexity, to determine the stage of their grammatical development, and to compare children with language problems with typically developing children or other subgroup of children with language problem. Dethorne et al. (2005) express that MLU is a frequently-used measure of expressive language ability within both clinical and research settings. It has been advocated as a useful measure for diagnostic language impairments as well as for monitoring treatment progresses.

The definitions of MLU mentioned above provide its following fundamental characteristics:

1. MLU is an indicator of children's productive grammatical complexity;
2. it denotes the stage of their grammatical development;
3. MLU is used to compare children with SLI and typically developing children;
4. it has already been frequently used as a global index of development of spontaneous language sample data;
5. MLU is the indicator of the development of language in young children;
6. MLU provides data to be used both in clinical setting and research activities;

In fact, all the definitions as well as main features of MLU developed over time are basically the extended and elaborated version of the concept of Brown (1973) who is credited as one of the pioneers of MLU method. In 1973 Brown published '*A first language: The early stages*' on child language, where he introduced some classical characteristics of MLU to be used as the measure and indicator of productive child language advancement, its grammatical or morphosyntactic regularities and limitations. Brown states that

“MLU is an excellent simple index of grammatical development because almost every kind of new knowledge increased length” (1973: 53)

In addition, Brown classified the age of children and proposed different values of MLU that matched with this proposed age-category as well as the nature of the language sample. He also provided some other important criteria for counting standard MLU values that are still being treated as classic indicators in the MLU literature.

It is worth mentioning that though Brown popularized the concept of MLU, but according to Parker et al. (2005) it was Nice who first used the term ‘Mean Length of Response’ (MLR), the previous version of MLU, to denote the predictable patterns of child language development in 1925.

Calculating MLU is a unique way to quantify language data. Quantification is badly needed in the domain of language study especially in the field of child-language acquisition process with a view to getting a numerical value of the data. Because this helps to find an approach to objectivity and authenticity of data that finally provides its particular construction as well as scientific insight (Klee, 1992).

As the MLU value has already proved its numerous potentialities to be used as an authentic means of clinical parameter, nowadays it is being widely applied in the clinical setting of language related studies. It provides the numerical data as the forms of morphosyntactic elements of child-language that indicates not only the state of normal language development, but also indicates the deficiency of diverse nature of linguistic abilities of children with language problems, including children with SLI. Simultaneously the MLU data getting from normally developing children have tremendous potential to be used as the basic outline to assess the deficiency of the language ability of children with language disorders. However the main aim of MLU, nowadays, has been determined as an indication of the level of morphosyntactic development of children exhibit in their language learning, though sometimes it is not fulfilled at all (Bol: 2003). In addition, MLU also tries to fulfil the following aims and objectives (Eisenberg et al. 2001):

1. identifying children in need of further language evaluation (Miller & Chapman, 1981);
2. diagnosing a language impairment (Bernstein & Tiegerman-Farber, 1997; Lahey, 1988; Miller, 1981; Nelson, 1998; Owens, 1999);
3. determining stage or overall level of language development (Bernstein & Tiegerman-Farber, 1997; Miller, 1981; Owens, 1999);
4. guiding further language assessment (Paul, 2000);

5. selecting goals fro remediation (Lahey, 1988; Miller, 1981; Owens, 1999);
6. measuring changing in language production (Fey, 1986; Paul, 2000);

### **Basic Guidelines for counting MLU**

Getting an authentic MLU value to be used as a clinical parameter. the clinicians as well as researchers have to follow some essential guidelines developed over the years. With a view to achieving the MLU value, there should be different types of language transcripts containing 50 to 100 utterances produced by either normally developing children or children with SLI. Transcripts should be gathered from a conversation of children either with their parents or investigators in a playful environment at home or in the clinic. An utterance of a language transcript usually varies in terms of its definition, length, nature and characteristics. Huddleston (1984) expresses that utterances containing at least one word should be produced orally (Huddleston, 1984). Utterance segmentation is also an important precondition to count MLU value. Here, we are providing different approaches concerning utterance segmentation techniques proposed by different clinicians and researchers (Eisenberg et al., 2001).

1. Utterances should be segmented primarily by apparent terminal intonation contour (Miller and Chapman, 1981: 155).
2. There should be pauses of greater than two seconds to determine utterance boundaries. Some times segmentation is relatively easy if the concerned child produces only one utterance per speaking turn (Leadholm and Miller 1992: 27).
3. Inhalation would be as a cue to segment utterance boundaries (Owens 1999)

In addition, there is a considerable debate among researchers on the issue of vocatives and answer to *yes/no* questions, whether these will be included as a part of utterance or segmented as different utterance. Alongside, the sentence conjoined with *and* should be separated into utterances and each with no more than one clausal conjunction (Eisenberg et al., 2001).

Sometimes exclusion of utterances which influence the data could be regarded as an important step to find out the authentic value of MLU. In this aspect most of the writers and researchers followed the instruction provided by Brown (1973) who stated that only fully transcribed utterances were to be included, and utterances 'with blanks' be excluded. According to Miller and Chapman (1981) utterances with a long string of conjoined words or phrases should be eliminated.

Lund and Duchan (1993), in addition, instructed that identical utterances, elliptical response to questions, and other sequence of enumeration and single word should be excluded.

Children's language samples should be collected from a free play setting environment with different types of materials that ensure free and spontaneous language data. These materials includes eating utensils, dolls, a barn with appropriate animals, gas station with vehicles, people figures, a school house and bus, a house with furniture, or construction activity with clay (Miller, 1981; Bernstein & Tiegerman-Farber, 1997; Leadholm & Miller, 1992). In fact, the materials and toys easily should enable children to be more communicative with their parents or investigators to produce language.

Children's home is considered as the most suitable place rather than the clinic regarding getting an appropriate MLU value from a language sample. Some studies revealed that children produced a higher MLU value at home with their parents than in the clinical setting. Scott and Taylor (1978) conducted a research experiment where MLU increased significantly for seven children out of twelve in the home condition.

The language sample size uttered by the children is also an important factor to get a valid MLU. Brown (1973) measured that a sample of hundred utterances suited appropriately in this regard. It was also supported by most of the researchers later. But a few of them, like Kemp and Klee (1997) and Hux et al (1993) argued that 50 utterances are also enough to get an appropriate MLU value (Eisenberg et al. 2001).

The timing of a standard sample size usually varies in terms of healthiness of children as well as the nature of research design. Miller (1991) proposed a 30 minutes total sampling time to yield a sufficient number of utterances especially for language impaired children who are usually less talkative and poorly interactive with the investigator compared to normally developing children. But Hux et al. (1993), quoted in Eisenberg et al. (2001), used sampling data for 15 minute's duration that did not yield sufficient number of utterances to get an appropriate value in their research design.

The utterances of children's language sample should be gathered in two conditions, the play with toys condition and the story telling condition

The play with toys condition could again be divided into: child-directed free play occurring both occasionally and on the regular basis on the one hand, and clinician-directed routine play on the other. In both conditions children are provided with different types of toys or/and pictures that positively motivate their communicative approaches to the investigators and parents, and help to create a healthy conversation environment. The story telling approach or narrative, on the other hand, involves the investigators telling as well as acting out a brief story with appropriate materials to the children first, and finally the children are asked to retell this. Most researchers emphasised that the latter one tends to produce a higher MLU. Stalnaker & Creaghead (1982), cited in Eisenberg et al. (2001), found higher MLU value for children in the narratives in their research design.

The MLU and age of children irrespective of normality and impairment are significantly correlated. Miller and Chapman (1981) found a high correlation between MLU and age for normally developing children, whereas Klee et al. (1989, 1992) identified the same correlation for children with developmental language disorders in three different studies. In another study, Blake et al. (1993) found the value of highest correlation ( $r = 0.70$ ) that is consistent with the results of all previous studies mentioned above.

MLU can be influenced by some external factors e.g. setting, conversational partner, tasks, topics and materials described above. Hence, there should be a conscious effort to control these variables in order to get a valid MLU in the research setting.

### **MLU values of ND children and children with SLI**

There appears a sharp difference between the MLU of normally developing (ND)<sup>1</sup> children and children with SLI<sup>2</sup>. ND children show a higher MLU indicating normal communication development with an appropriate linguistic ability, whereas children with SLI exhibit the lower one denoting different types of deficiencies concerning communicative as well as linguistic expression. In fact, a lot of factors mentioned affect the language sample of children with SLI that tend to show a reduced MLU compared to normal children.

ND children gradually develop their linguistic abilities with a consistent manner. Children with SLI, on the other hand, usually fail to show such consistent language development in their early life. Hence, their language samples possess numerous types of linguistic deficiencies that produce a lower MLU. The following reasons are mainly responsible in this regard. First of all, children with

SLI perform less morphosyntactic ability or more syntactic errors including omission of grammatical morphemes in their language sample. They also use frequent elliptical question responses, poor logical proposition per utterance and evidence, and less control for formal syntactic markers. All these errors mentioned above cause to reduce MLU of children with SLI significantly.

Johnston and Khami (1984) conducted a research experiment aiming at comparing syntactic and semantic variables in the utterances of language-impaired children. The result of this study provided some valuable findings regarding accounting the common errors of children with SLI's utterances mentioned below.

Compared to younger and MLU-matched normal children, language-impaired subjects produced sentences which were on average grammatically less complex, they made more errors in their use of grammatical forms; and expressed fewer logical proportions per utterance.

The former two mainly indicate morphological inadequacies, whereas the latter denotes the poor sequential aspect of the sentence uttered by the children with SLI. Again, Johnston and Khami made a comparison between the utterances of both ND and children with SLI children that children with SLI talked more often about ongoing events and less often about intentions or necessities and more often about self-movement action verbs, such as come, go, run, fly and walk. Also they expressed fewer adverbial predicates.

In short, the findings of their research experiment provided some new insights in the MLU literature concerning characterizing the utterances of children with SLI.

Bol and Kuiken (1988, 1990) in another study also identified that Dutch children with SLI produced significantly fewer personal and possessive pronouns, less verb inflections, and sentence-subjects compare to MLU-matched typically developing children.

### **MLUm and MLUw: basic concept**

Many the research findings on SLI indicate that deficiencies in morphosyntactic elements, more specifically morphemes are the prime indicator of a reduced MLU. Hence, Brown mainly popularized the term 'Mean length of utterance in morphemes' (MLUm) in order to interpret the nature of the morphemes of the utterance of both ND and children with SLI.

Parker et al. (2005) stated that all speech-language pathologists and researchers used the notion 'Mean length of utterance in words' (MLUw) before Brown's

introduction to the concept of MLUm in 1973. Actually MLUw, the measure of children's gross language development, was the immediate previous form of MLR, the mean length of response of children's utterance. But MLUw failed to identify *morphemes*, the basic element of children's utterance, and count the length of utterance in a traditional way. Hence, Brown developed an advanced technique as well as a new procedure named MLUm with a view to computing utterance length accurately. In addition, he proposed a different MLUm value correlated with different stages of children's age. As Parker et al (2005) stated:

'...Brown constructed five stages of linguistic development based on MLU values of 1.75, 2.25, 2.75, 3.5 and 4.0, with an MLUm of 1.75 corresponding to Stage 1 and MLUm of 4.0 corresponding to Stage V.' (2005: 367)

Thus, MLUm was adapted widely by the researchers and clinicians who started to use this procedure in their clinical and research setting. In addition, they applied MLUm -

1. to determine the stage of overall level of language development (Bernstein & Tiegerman-Farber, 1997; Miller & Chapman, 1981)
2. to identify children in need of further language evaluation (Miller & Chapman, 1981)
3. to diagnose and identify language impairment (Bernstein & Tiegerman-Farber, 1997; Lahey, 1988; Miller & Chapman, 1981; Owens, 1999)
4. to guide further language assessment (Paul, 2000)
5. to measure change in language production (Fey, 1986; Paul, 2000)

It is worth mentioning that though MLU, a generic form for both MLUm and MLUw, has been explored and developed all over the world after Brown and nowadays this term is also used widely as two different forms in the MLU literature and maintain the following differences.

MLUm	MLUw
Developed by Roger Brown in 1973 to measure utterance length	Very elementary procedure for measuring utterance length
Usually a complex system for counting morphemes	Simple system for counting word
Manually, a time consuming approach	Easy and faster approach
Better predictor of grammatical development of children	Does not provide enough information about grammatical development of children



## Present Research Design

In the present research experiment we tried to identify the relationship as well as differences between the MLUm and MLUw in a normally developing child and in a child with a language disorder. The data were collected from Child Language Data Exchange System (CHILDES) <sup>3</sup>, an existing internet database of child-language.

It has been mentioned earlier that MLU of the language sample of children can be measured either in words or in morphemes. Even the result of MLU can be found on the basis of children's uttered syllable. Since counting syllable of children's utterance is a difficult job, researchers ignore such MLU counting method and mainly depend on either MLUm or MLUw to measure children's lexical ability. In the following some research works performed on counting both MLUm and MLUw can be mentioned in order to get the nature of the result of these two procedures.

A research work conducted by Arlman-Rupp et al. (1976) on the language sample of Dutch children stated that the result would be similar for both MLUm and MLUw if the children are not older than 2.6 years old.

Hickey (1991) and Thordardottir & Weismer (1998) found high correlation between MLUm and MLUw in their two different research designs on Irish and Icelandic languages respectively.

Butt (1999), quoted in Bol (2003), conducted a research experiment on counting both MLU words and morphemes for several languages where the authors also found high correlation between these two methods.

Recently Parker et al. (2005) performed a research work on the language sample of 40 English-speaking children collecting from CHILDES database and found very high correlation of 0.99 between MLUm and MLUw.

So, in relation to the previous studies mentioned above, the main **aims** of this research experiment were to make a comparison between the value of MLUm and MLUw gathered from data of ND and children with SLI, and identify the language deficiency of children with SLI in comparison with normally developing children.

With a view to fulfilling the aims mentioned the following **objectives** were performed:

## Method

### Language sample source and data collection

In order to collect data we have chosen both ND and SLI English-speaking children with similar age children from CHILDES. The name of the ND child is Adam. He has

been taken from the 'English Corpus' file 'Brown' in CHILDES database. He was born in 4 July 1960. The data was collected by investigator in a play with toy condition started from 8 October 1962. Thus, during data collection his age was 2 years and 3 months. The name of SLI child, on the other hand, is also Adam. The data of SLI Adam existed in the 'English Corpus' file 'Conti2' in CHILDES. He was born in England and the date is unknown. But he was 2 years and 1 month old during the time of sample collection. His data was collected by his parents in free play with toys condition. As both ND and SLI children have the same name in this research experiment, we will call them as Adam (ND) and Adam (SLI).

### **Rationale for choosing identical age of children**

Rather than their MLU matching, two ND and SLI *age-matched* children have been chosen in this research experiment. The main ground for selecting such age-matched children is to compare their linguistic ability. Because similar aged ND and children with SLI children usually show differences in their productive language complexity. Brown (1973) explained that 'two children matched for MLU are much more likely to have speech that is, on internal grounds, at the same level of constructional complexity than are two children at the same chronological age' (1973: 55).

### **Counting MLUm and MLUw**

The MLUw of the utterances of both ND and children with SLI gathered from the following syntax of CLAN.

1. mlu +t\* CHI @

The syntax mentioned above provided MLUw value of a certain number of utterances. Then, with a view to getting the value of 100 utterances we applied the following syntax.

2. mlu +zXu-Yu +t\* CHI @

Actually syntax no. 2 is a hypothetical approach, not the version that was applied in the CLAN program. Here X and Y indicate the number of utterances from which we got the value of 100 utterances by subtracting these two numbers. Suppose, we got the MLUw value of 1238 utterances by applying command number 1 from the language sample of a child. Then, in order to find the MLUw value of 100 utterances from this language sample, we changed the syntax 2 into following manner and applied the syntax again.

3. mlu +z1139u-1238u +t\* CHI @

On the other hand, to get MLUm value of both these ND and children with SLI, we calculated the utterances manually. These are as follows:

We counted the number of morphemes of every 100 utterances by hand and, then, divided these total numbers of morphemes by 100. Thus, we got the value of MLUm. We applied this procedure at every time to get the all values of MLUm of both ND and children with SLI.

Table 1 and Figure 1 show the result of MLUm and MLUw value of Adam (ND), the normally developing child, whereas Table 2 and Figure 2 indicate the value of MLUm and MLUw of Adam (SLI), the SLI child.

Age	MLUw	MLUm
2.3.04	2.41	2.61
2.4.03	2.86	3.28
2.5.12	3.5	4.89
2.6.03	4.18	5.88
2.8.16	3.35	4.04
2.10.16	3.47	4.29
3.0.11	4.56	5.75

Table 1: MLUm and MLUw of normally developing child

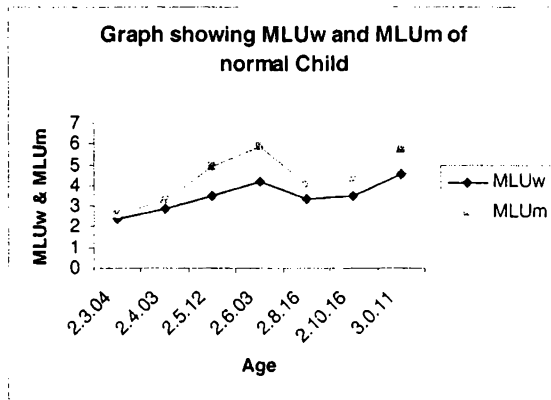


Figure1: MLUw and MLUw of normally developing child

Age	MLUw	MLUm
2.1.04	2.24	2.81
2.10.02	3.14	4.46
3.2.29	2.93	4.01
3.4.20	3.08	3.74
3.6.29	2.72	3.14
3.7.20	2.55	2.72
4.11.04	3.72	4.75

Table 2: MLUm and MLUw of SLI child

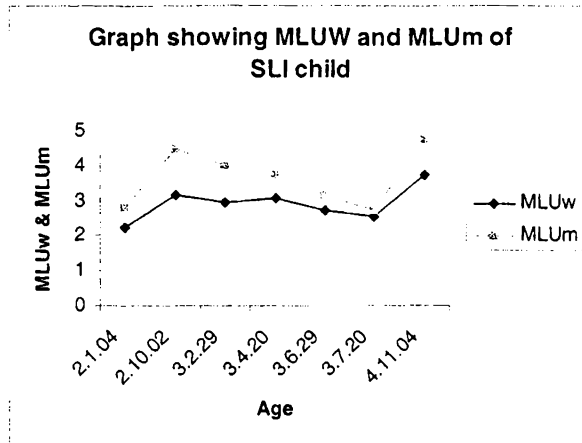


Figure 2: MLUw and MLUm of SLI child

Compared to Adam (ND), Adam (SLI) shows a reduced value in both MLUm and MLUw. This reduced value of Adam (SLI) indicates his deficiency in language development. During counting MLUm by hand, the following linguistic deficiencies have been identified in the utterances of Adam (SLI);

1. sentence was not complete;
2. frequently overlapping of words especially nouns;
3. communication gap between child and mother;
4. elliptical question response e.g. omission of bound morpheme, copula, and even main verb in the sentence;
5. dominance of conjunction and emotional expression;

All these linguistic deficiencies ultimately reduced the MLU of Adam (SLI) that appeared at his MLUm and MLUw result. Alongside, it is also observed that there is hardly difference between MLUm and MLUw in the result of both ND and SLI child.

### Statistical application and results

The correlation coefficient was calculated to identify the relationship between MLUm and MLUw value of both ND and children with SLI. The results exhibited high correlations for both categories.

The correlation between MLUm and MLUw Adam (ND) was  $r^2 = 0.96924111$ . (See Figure 3)

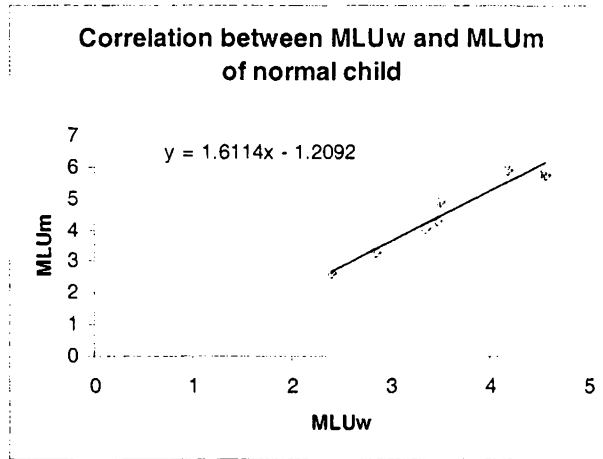


Figure 3: Correlation between MLUw and MLUm of normally developing child

The correlation between MLUm and MLUw of Adam (SLI) was  $r^2 = 0.91957618$ . (See Figure 4)

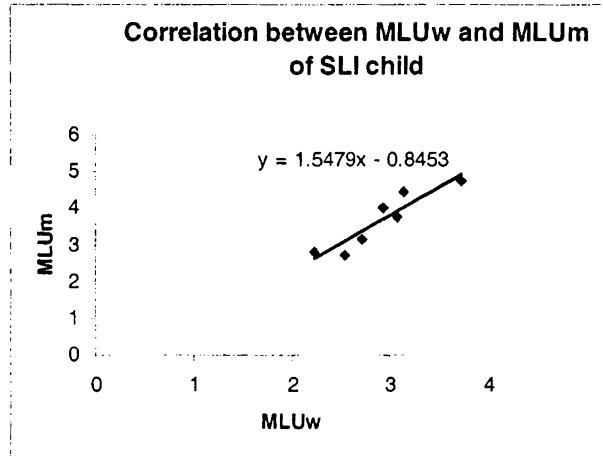


Figure 4: Correlation between MLUw and MLUm of SLI child

## Discussion

The result determining the relationship between MLUm and MLUw of both ND and children with SLI children in this experiment is similar to some other previous research experiments designed on the this aspect (Arلمان-Rupp et al, 1976; Hickey, 1991; Parker et al, 2005). The finding of this result is consistent

with the hypothesis that MLUm maintains a positive correlation with the MLUw of the language sample of both normally developing children and children with language impairment, at least for English.

After all, the high correlation between MLUm and MLUw suggests that it is unnecessary to use MLUm as a means of calculating MLU, especially given the uncertain nature of morpheme development (Hickey, 1991). Counting MLUm from the utterance of child-language is more difficult and time consuming jobs for researchers. In addition, they frequently faced a lot of problems to implement MLUm counting for the following reasons (Hickey, 1991; Malakoff et al., 1999; Parker et al., 2005). The inflection differences that exist across language and arbitrary decisions regarding productivity of morphemes are to be made. There are also dialectal differences to be dealt with.

In addition, for some languages like Hebrew where increased complexity often does not imply an increase in length and inflectional morphemes are not added to word roots in a linear fashion, MLUm does not work properly (Dromi & Berman, 1982). Hence, a lot of clinicians and researchers prefer MLUw as a reliable indicator of child-language development because counting MLUw is more language neutral. It can be applied across languages easily and comfortably. Arlam-Rupp et al. (1976) explained that counting word is easier, faster, more reliable and theoretically sounder because no ad hoc decisions need to be made here. Alongside, according to Hickey (1991) MLU counted in words was found to be a measure which best balanced effectiveness and ease of application. In addition, the findings of research design conducted by Parker et al. (2005) identified some important points in favor of using MLUw. These are as follows:

1. basic rules using for computing MLU in morpheme can easily be eliminated in counting MLU in words where every words is counted properly.
2. using MLUw techniques, investigators would not have to make arbitrary decisions about whether morphemes are used productively.
3. MLUw can be used more easily across languages and dialects.

Finally, as the result of this experiment found MLUw and MLUm are highly correlated for both the utterances of ND and children with SLI, MLUw should be preferred. In fact, counting MLUw is easier, less technical in terms of grammatical complexity, and it is a language or dialect neutral procedure. In addition, the value of MLUw works as effective as the value of MLUm in order to get the fact about the nature of the language development of both ND and children with SLI. But sometimes it is not as fruitful as MLUm value when we would like to get information about the productive grammatical development of

children especially their linguistic richness, morphological structure, and syntactic complexity. After all, as an indicator of morphosyntactic development of child-language, MLU is still unique and more appropriate.

### Notes

1. In terms of language development those who grow up without any language deficiency are considered as normally developing (ND) children in the literature of Child Language Studies.
2. SLI stands for Specific Language Impairment. Though children with SLI do not face any kind of biological problem, their language development is delayed due to unknown causes.
3. CHILDES is a computerized child language component of the Talk Bank of various languages all over the world. It is a system for sharing and studying conversational interactions. For more information please see MacWhinney (2000).
4. CLAN is a computer-software used for counting different values of child language data.

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