Relational Variables for Predicting Child Language Development from Language Transcripts

Larry Barnes

West Texas A&M University

Canyon, Texas USA, 79016

E-mail: lbarnes@mail.wtamu.edu, Phone: 806-651-5108

Abstract

Analyzing child language transcripts for the purpose of identifying developmental language progress is commonly used but met with challenges including the determination of what variables to analyze. A multivariate approach to analysis was used in this research design to determine if a set of variables is more predictive than others within language samples. Transcripts from 56 English proficient speaking fourth graders were used to examine correlation between nine variables. Results established statistical correlations exist between MLU, TTR, and Mazes. Implication on transcript analysis is discussed.

Keywords: Child language, transcript analysis, development, MLU

Introduction

The analysis of a child's language development often relies on comparing characteristics obtained from a language sample with data obtained from normally developing children. It is generally understood that although formal assessment tools can provide meaningful data regarding a child's language development, less formal approaches allow for a more comprehensive assessment of receptive and expressive skills in conversational contexts (Retherford, 1993, p. 1). For this reason analysis of language transcripts have become widely used by teachers and speech/language therapists. However, the process for analyzing such transcripts remains diverse and questionable. The purpose of this research was to determine if a correlated set of variables exists in language samples of normally developing children that will assist the evaluator in making sound judgments regarding a child's developmental language progress.

Isolated variables within language samples have often been used in comparison analysis. such as mean length of utterance (MLU), type token ratio (TTR), mazes, etc. are often evaluated as fixed variables when compared to normative data tables such as Brown's Developmental Stages. Critics, however, argue that language development assumes a quasi- parallel nature of learning i.e. mastery of one ability is not needed to master other language abilities (Bernthal, Bankson, & Flipsen, 2009, p. 359). This concept of language learning has led some to question the use of fixed variable analysis as an appropriate predictor of developmental

Despite the progress made in identifying the nature of child language development, the validation of specific variables as predictors of overall language performance remains in question (Miller, 1981). Semantic diversity for example, has been used extensively to investigate language development (Bradac, Courtright, Schmidt, & Davies, 1976; Burroughs, 1991; McEvoy & Dodd, 1992) however, limited validation of semantic diversity as an index of language development has occurred (Watkins, Kelly, & Harbers, 1995). Some research have ruled out semantic diversity measures as stand-alone predictors of language development of school aged children when derived from traditional language sampling methods (Hess, Haug, & Landry, 1989).

Similar concerns have been noted regarding MLUs. Following Brown's (1973) documentation of MLU as a correlated measure to language development, counting morphemes in language samples became a widely accepted practice as a measure of child language development (Parker & Brorson, 2005). Various methods of calculation have been proposed over the years. Analysis of these methods revealed significant concerns about MLU as a single index. Specifically, research indicates that MLU can vary as much as 26 to 49 percent depending upon the method of evaluation (Johnston, 2006, p. 116). Researchers caution that MLUs derived from language samples with limited discourse properties and proportion of question responses will likely underestimate a child's language competence (Johnston, Miller, Curtiss, Tallal, 1993).

Mazes demonstrate more promising results when analyzed as predictors of language competence. Children with specific language impairment demonstrate more mazes in their language samples than do controls (Nettelbladt & Hansson, 1999). Loban (1963) began the examination of mazes as indicators of normal language development. His research determined that during the first four years of school, children considered to be linguistically competent demonstrated a significant reduction in number of mazes. Nippold (1993) corroborated Loban's work through an examination of developmental markers in adolescent language.

Findings indicated that as language skill level decreased the number of mazes increased. Other researchers however, caution that mazes themselves can, like MLU, underestimate a child's language ability. Fagan (1982) argues that the more complex the sentence the greater the probability that mazeswill be used. More recent insight suggests some mazes such as hesitations have cognitive and linguistic function and should not be viewed as detrimental to language development (Edrington, Buder, & Jarmulowicz, 2009). Realizing the limitations of fixed variable analysis of language samples, Gabani et al. (2009) utilized a cross-validation approach to language sample evaluation of adolescents. Findings indicated some improvement in prediction accuracy of language competence occurred as a result of a refined feature set used in analysis. Limitations of the study include an uncertainty of which variable combinations were valid due to a limited number of features considered and a focus on adolescent language samples makes it difficult to generalize the findings to younger populations. Nevertheless, this research established the need for further investigation into a multivariate approach to language sample analysis for the purpose of predicting language competence in children.

Method

This study used a descriptive research design observing the language behavior of 56 English proficient fourth graders. Subjects were selected from within a rural independent school district. Recruitment took place by sending notices and consent forms to all fourth grade parents within the district however, of the 62 signed consent forms returned 2 subjects dropped out of the study because of unavailability and 4 were not used because of difficulty in securing a large spontaneous language sample.

The research sample presented demographically as 51% male, 49% female, 79% Caucasian, 4% black, 16% Hispanic, and 1% Asian. This research sample mirrored well the overall demographic profile of the district. Children were excluded from the study if they had a history of hearing, speech, language, or cognition delays or disorders as identified by parent or teacher. Variables of socioeconomic status and bilingualism were not controlled secondary to rule out as having significant effect on the variables analyzed in this research design (Silvaroli & Whitcomb, 1967; Bedore, Fiestas, Pena, & Nagy, 2006).Eight graduate student clinicians were used to collect the language samples. Clinicians were trained in language sample collection and completed at least one semester of clinical practicum prior to collecting samples. Clinicians met one-on-one with children in a quiet, unoccupied classroom at their school. Prior to digitally audio recording the session, each clinician explained to the child the importance of feeling free to speak as much as they wanted in regard to the three questions presented. Clinicians refrained from interrupting or interjecting while the child answered each question. Clinicians also presented each question one at a time then pausing allowing the child plenty of time to respond.

Non-verbal gestures were used to help elicit responses. Clinicians were instructed to respond to answers with rewording of child's comments or with, "That's interesting. Tell me more about that".

The following questions were used in the protocol:

1) What can you tell me about your family?

2) What can you tell me about your classes?

3) What do you like to do when you are not in school?

This interview protocol was adopted from research that established it as a valid and reliable method of language sample collection (Evans & Craig, 1992).

Audio recordings were archived onto a compact disc. Two additional student clinicians not associated with the collection of the samples were used to transcribe. The two student clinicians were trained in the transcribing process and required to demonstrate their skill level in transcribing prior to beginning this project. This researcher randomly selected approximately 10% of the transcribed samples and reviewed them in conjunction with the audio recordings for accuracy. Less than .01% of the transcriptions contained errors. Those errors that were noted dealt with punctuation and did not interfere with the coding of the language sample itself. Transcripts were analyzed using the Systematic Analysis of Language Transcripts (SALT) 2008 research software. A data table accounted for the following variables: number of utterances, total number of words, and mean length of utterance by words, mean length of utterance by morphemes, type token ratio, utterances with mazes, number of mazes, and number of maze words. Statistical analysis was performed on the data set to determine if a significant relationship exists between the variables.

Results

The average number of utterances represented in the data set for subjects was 45 and the mean number of words for each sample was 494. This sampling size exceeds those of previous research validating language sample collection methodologies (Evans & Craig, 1992). Examination of differences between MLU measured by words (MLUw) and MLU measured by morphemes (MLUm) revealed statistical correlation between the two (significant at the 0.01 level (2-tailed)). This corroborated previous research findings suggesting that MLUw and MLUm can be used interchangeably and with equal reliability in measuring a child's language development (Parker & Brorson, 2005).

A Pearson product moment correlation coefficient analysis revealed significant relationships between three of the nine variables. Correlation was significant at the 0.01 level (2 tailed) for MLUw, TTR, and mazes. Graph 1 demonstrates the linear relationship between semantic diversity (TTR) and mazes. As semantic diversity ratio increased the number of maze words used in the language samples decreased. The coefficient of determination (r^2 = .95) for maze words used is considered strong. This indicates 95% of the total variation within the language sample set can be explained by the linear relationship with mazes. Similar findings are identified in the relationship between semantic diversity and MLUm (graph 2). Surprisingly, as semantic diversity increased the MLU decreased. This suggests a greater number of different words were used in shorter responses to contextualized language questions. It should be noted that previous research indicates semantic ratios greater than .45 are not necessarily indicative of greater language competency (Retherford, 1993, p.82). This was corroborated through the coefficient of determination (r^2 = .62) related to semantic diversity. This indicates only 62% of the total variation of the language sample set can be explained by the linear relationship with semantic diversity. The low percentage is not considered to be a strong effect.

MLU demonstrated a significant relationship with the number of maze words used (graph 3). As MLU increased the number of mazes increased. This corroborated previous research that suggests some mazes are predicted to increase with greater sentence complexity (Fagan, 1982). The coefficient of determination (r^2 = .99) for MLU is considered strong. This indicates 99% of the total variation noted within the language sample set can be explained by the linear relationship with MLU.

Discussion

The purpose of this research was to determine if a correlated set of variables exists in language samples of normally developing children that will assist the evaluator in making sound judgments regarding a child's developmental language progress. The findings suggest three correlated variables do exist: MLU, TTR, and Mazes. The linear relationships between the three variables suggest that evaluations of child language transcripts for the purpose of identifying possible delays should include a multivariate analysis. This corroborates previous research (Gabani et al., 2009) suggesting analysis of stand-alone variables in language transcripts do not serve as accurate predictors of language delay.

Figure 1 illustrates the strength of relationship between the three variables that noted statistical significance. The size of the gears represented in the figure identifies the comparative power each variable had on the overall language sample while working directly with each other. Note that MLU demonstrates the greatest strength, followed by mazes, and finally semantic diversity. Although the stronger variables should not be used as stand-alone predictors, the strength does indicate the importance of variable relationships within language samples. For example, to analyze a sample excluding MLU would be underestimating the influence in relation to the other variables within the sample. Likewise, to concentrate more on semantic diversity analysis would overestimate the affect on the language sample.

All three variables should be considered in analysis allowing for their respective proportionate influence in making sound judgments regarding a child's developmental language progress.These finding highlight another critical need in language sample analysis. Because MLU, Mazes, and TTR have such a strong correlated outcome, normative data for all three variables need to be routinely updated to insure accurate prediction in decision making.

Future Research

(Lane & Bergan, 1988; McCabe et al., 1996) has identified numerous instructional and environmental influences on child language development. These influences can change over time causing shifts in developmental norms. Additional research in normative data tables and in further use of language sample analysis is warranted. Teachers and speech-language pathologists can confidently rely on a multivariate analysis of child language samples in accurately predicting language development. The use of the three variables identified in this study will provide evaluators with the relational data necessary to make sound decisions regarding language progression. Evaluators are highly encouraged to use language sample analysis using a multivariate approach as defined by this study.

References

Bedore, L., Fiestas, C., Pena, E., & Nagy, V. (2006). Cross-language comparisons of maze use in spanish and English in functionally monolingual and bilingual children. *Language and Cognition, 9*, 233-247.

Bernthal, J., Banson, N., & Flipsen, P. (2009). Articulation and phonological disorders: Speech sound disorders in children, 6th ed. NY: Pearson Publishing.

Bradac, J., Courtright, J., Schmidt, G., & Davies, R. (1976). The effects of perceived status and linguistic diversity upon judgments of speaker attributes and message effectiveness. Journal of *Psychology, 93*, 213-220.

Brown, R. (1973). A first language: The early stages. Cambridge, MA: Howard University Press.

Burroughs, E. (1991). Lexical diversity in listener's judgments of children. *Perceptual and Motor Skills, 73*, 19-22.

Edrington, J., Buder, E., & Jamulowicz, L. (2009). Hesitation patterns in third grade children's derived word productions. Clinical *Linguistics & Phonetics, 23*, 348-374.

Evans, J., & Craig, H. (1992). Language sample collection and analysis: Interview compared to freeplay assessment contexts. *Journal of Speech and Hearing Research, 35*, 343-353.

Fagan, W. (1982). The relationship of the "maze" to language planning and production. *Research in the Teaching of English, 16*, 85-95.

Gabani, K, Sherman, M., Solorio, T., Liu, Y., Bedore, L., & Pena, E. (2009). A corpus-based approach for the prediction of language impairment in monolingual English and Spanish-english bilingual children. *Human Language Technologies: The 2009 Annual Conference of the North American Chapter of the ACL*, Boulder, Colorado, 46-55.

Hess, C., Haug, H. & Landry, R. (1989). The reliability of type-token ratios for the oral language of school age children. Journal *of Speech and Hearing Research, 32*, 536-540.

Johnston, J. (2006). Thinking about child language. Eau Claire, WI: Thinking Publications.

Johnston, J., Miller, J., Curtiss, S., & Tallal, P. (1993). Conversations with children who are language impaired: Asking questions. *Journal of Speech, Language, and Hearing Research, 36*, 973-978.

Lane, S., & Bergan, J. (1998). Effects of instructional variables on language ability of preschool children. American Educational Research Journal, 25, 271-283.

Loban, W. (1963). The language of elementary school children. NCTE Research Report No. 1. Urbana, IL: National Council of Teachers of English.

McCabe, J., Jenkins, J., Mills, P., Dale, P., Cole, K., & Pepler, L. (1996). Effects of play group variables on language use by preschool children with disabilities. *Journal of Early Intervention, 20*, 329-340.

McEvoy, S., & Dodd, B. (1992). The communication abilities of 2 to 4-year old twins. *European Journal of Disabilities of Communication, 27*, 73-87.

Miller, J. (1981). Assessing language production in children: Experimental procedures. Baltimore: University Press.

Nettelbladt, U., & Hansson, K. (1999). Mazes in swedish pre-school children with specific language impairment. *Clinical Linguistics & Phonetics, 13*, 483-497.

Nippold, M. (1993). Developmental markers in adolescent language: Syntax, semantics, and pragmatics. *Language, Speech, and Hearing Services in Schools, 24*, 21-28.

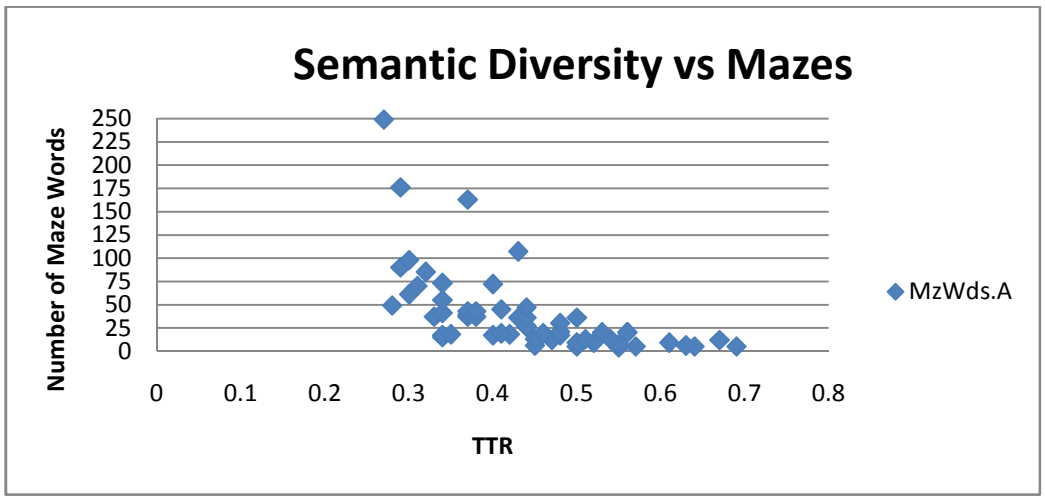
Parker, M., & Brorson, K. (2005). A comparative study between mean length of utterance in morphemes (MLUm) and mean length of utterance in words (MLUw). *First Language,25*, 365-376.

Retherford, K. (1993). Guide to analysis of language transcripts, second edition. Eau Claire, WI: Thinking Publications.

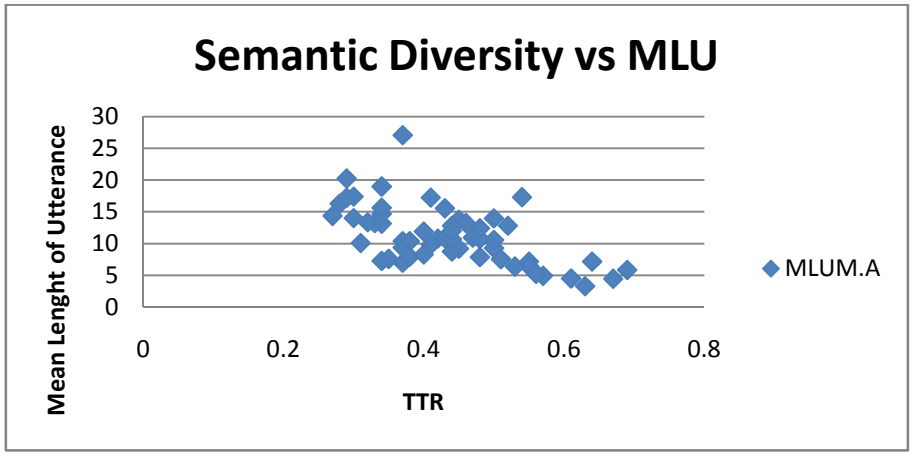
Silvaroli, N. & Whitcomb, M. (1967). A comparison of the oral language patterns of three low socioeconomic groups of pupils entering first grade. Retrieved December 21, 2009, from the ERIC database.

Watkins, R., Kelly, D., & Harbers, H. (1995). Measuring children's lexical diversity: Differentiating typical and impaired language learners. *Journal of Speech, Language, and Hearing Research, 38*, 1349-1355.

Graph 1. Relationship between semantic diversity and Mazes



Graph 2. Relationship between semantic diversity and MLU



Graph 3. Relationship between MLU and Mazes

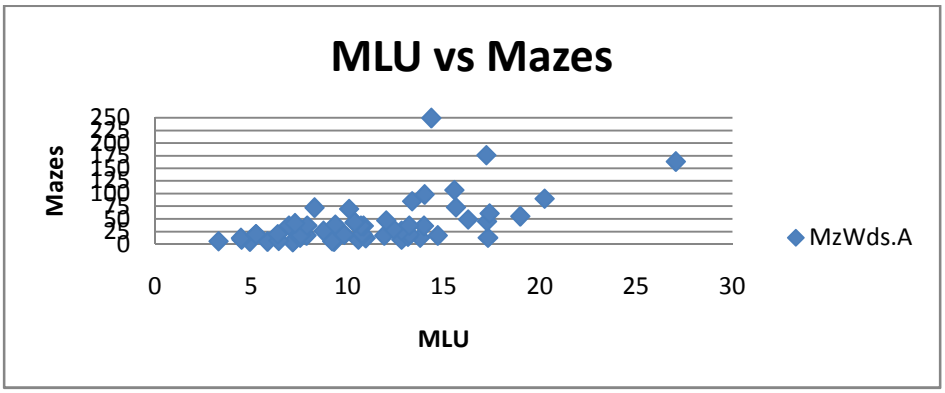


Figure 1. Strength of relationship between the three variables and the overall language sample set