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A Comparison of Norm-Referenced, Traditional, and Computer-Assisted Language Assessments

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A Comparison of Norm-Referenced, Traditional, and Computer-Assisted Language Assessments

(TITLE)

BY

Michel P. Helmke

THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
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Abstract

Current literature in the field of communication disorders suggests that traditional norm-referenced tests may yield erroneous or misleading information regarding a child's level of language acquisition. Additional research suggests that the most valid and reliable technique for determining a client's level of linguistic expertise is language sampling and analysis. Language sampling and analysis has traditionally been rejected as a means of evaluation, especially for the school-age child, due to the length of time necessary to complete such analyses. In recent years, language sampling and analysis techniques have been redesigned as computer software application programs. Computer software application programs may significantly reduce the time required to complete language sampling and analysis and increase the application of this validated method of language assessment. Implementation of language sampling and analysis procedures through software application would reduce the reliance on traditional norm-referenced tests thereby increasing the reliability and validity of language assessments.

The purpose of this research was to compare both the time required and the time to data ratio in three assessment paradigms. These paradigms include the traditional norm-referenced assessment, the traditional "by-hand" language sampling and analysis procedure, and the computer-assisted language sampling and analysis procedure.

Significant differences among assessment times suggested that computer-assisted langauge analysis took significantly less time than manual language sample analysis. Analysis of time/data ratio indicated that computer-assisted analysis provided the most information per unit of time. These results supported the use of computer-assisted software programs for speech and language service providers.

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Submitted in Partial Fulfillment of the Requirements
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Introduction

Rationale

A concern which faces many speech-language pathologists is the need to perform valid language assessments of their clients. Many of these professionals use decontextualized, norm-referenced tests in order to complete their assessment of a child's language use.

Many researchers have come to criticize the over-reliance on norm-referenced tests as the primary means of assessment (Swisher and McCauley, 1984; Leonard, Prutting, Perozzi and Berkley, 1978; and Muma, 1978). These authors state that contextual restrictions may inhibit a child's performance on a norm-referenced test, thus providing a distorted picture of the child's natural language abilities.

The use of spontaneous language sample analysis as an assessment technique is suggested by research (Prutting and Gallagher, 1983; McLean and Snyder-McLean, 1978). Professionals who have examined the use of spontaneous language sample analysis report that by eliciting the child's language in a naturalistic environment, the speech-language pathologist is presented with a more valid estimate of the child's language ability. These authors also report the ease with which language sample analysis can be used in an assessment-therapy-reassessment paradigm in which a language sample is elicited, therapy is commenced, and reassessment is performed via analysis of another

language sample.

A key issue in the use of spontaneous language sample analysis is one of time. Many speech-language pathologists do not have the time required to perform an in-depth analysis of a child's language (Vetter, 1985). Additionally, the results one interprets from a language sample are often in the form of developmental sequences expressed in months or years (Bloom and Lahey, 1978; Bloom, 1970). Many professionals use a severity rating scale in order to organize their service caseload. Developmental sequences are not conducive to this method of caseload organization (Pendergast, 1983).

The advent of computer technology and its application to the field of speech-language pathology may have an impact on the way language assessments are performed. Already computer software programs, which are capable of analyzing a spontaneous language sample for a variety of semantic and syntactic forms, are commercially available.

The purpose of this study was to compare the time needed for three different types of language assessment. The first was administration of a typical, norm-referenced test of receptive and expressive language. The Preschool Language Scale (Zimmerman, Steiner, and Pond, 1979) was employed in this capacity. The second was a manual analysis of a spontaneous language sample using the Developmental Sentence Score procedure (Lee and Canter, 1971). The final type of assessment involved a computer-assisted analysis of

a spontaneous language sample using the Parrot Easy Language Sample Analysis procedure (Weiner, 1985).

The data from this study indicated that the Preschool Language Scale took significantly less time to administer and score than completion of either of the language sample analysis procedures. The data also indicated that computer assisted analysis took significantly less time than manual analysis. Data for the second question revealed that the Parrot Easy Language Sample Analysis procedure provided significantly more information per period of time than either of the traditional language assessment procedures. The difference was enhanced when analysis time for the PELSA was not calculated, and only the time needed for eliciting and entering the language samples was computed. The results of the study support the use of computer assisted language sample analysis as a means of enhancing assessment of language.

A Comparison of Norm-Referenced, Traditional, and Computer-Assisted Language Assessments

An issue which currently faces speech-language pathologists is the implementation of valid language assessment procedures. The need to complete a large number of assessments in order to organize the service caseload has forced many professionals to perform language assessments in as short an amount of time as possible. The result of this time pressure leads many speech-language pathologists into a cycle of assessment-therapy-reassessment which relies on traditional, decontextualized, norm-referenced tests. Frequently, the child's areas of weakness as indicated by test performance are used as the basis for planning therapy goals. To complete the cycle, the same test is used as a reassessment tool to evaluate the child's progress during therapy.

Many researchers, however, have come to question the use of decontextualized norm-referenced measures for providing valid and adequate profiles of a child's receptive and expressive language skills (Swisher and McCauley, 1984; Leonard, Prutting, Perozzi and Berkley, 1978; and Muma, 1978). Researchers have examined the use of norm-referenced tests and conclude that there are several deficiencies which must be recognized when such techniques are emphasized within the assessment-therapy-reassessment cycle. These deficiencies may yield wrong or misleading information that

may result in prolonged, inaccurate, or misguided treatment.

A primary drawback to using psychometric tests as the sole diagnostic procedure is that a child's ability in a specific area is based upon performance on only one or two test items (Muller, 1985; Leonard, Prutting, Perozzi, and Berkley, 1978). Many tests which purport to elicit a representative sample of a child's language base the resulting scores on a relative paucity of information. The Preschool Language Scale, Revised Edition (Zimmerman, Steiner, and Pond, 1979) offers a typical example of this limitation. The Preschool Language Scale provides a quick and easy means of evaluating a child's language in the receptive and expressive modes. One area targeted in the receptive portion of the test is the understanding of certain prepositions. When taking the test, the child has one opportunity to demonstrate knowledge of prepositions by placing a block in a location specified by the clinician. The speech-language pathologist should perform further assessment of the child's use of prepositions before deciding whether this is an area in need of remediation. Neither competence nor need for remediation should be based on so limited a performance sample (Muma, 1978). Unfortunately, the Preschool Language Scale provides no further opportunity for evaluation.

Not only may the performance sample elicited by the norm-referenced test be limited, but the communicative context in which the language assessment is placed may be

similarly restrictive. Another commonly used norm-referenced test is illustrative of this problem The Peabody Picture Vocabulary Test, Revised Edition (Dunn and Dunn, 1978) uses a picture pointing task in order to assess a child's receptive language skills. Pointing to pictures within this restrictive communicative and semantic context is atypical of a true communicative interaction. The disparity between true communication and the methods by which results are obtained on the Peabody Picture Vocabulary Test significantly limits the diagnostic validity of this assessment tool.

In addition to the limits of psychometric tests in providing an adequate sample of the child's language skills in a varity of communicative contexts, there are other drawbacks to using these measures during the assessment-therapy-reassessment cycle. Swisher and McCauley (1984) and Muma (1978) have stated that so small a sample is inadequate for estimating treatment gains. Once a therapy cycle has been completed, the speech-language pathologist reassesses the child and may find that there has been no change in the child's performance level. Treatment effectiveness may not be identified within the limited items available from a norm-referenced test. The reverse of this dilemma occurs when readministration of the norm-referenced tests indicates significant gain on the child's part. The speech language pathologist cannot know, due to the limited sample involved, whether improvement reflects treatment

success, learning test items, or treatment that encouraged training the test items.

The alternative for assessing a child's language skills is the use of a language analysis based on a spontaneous speech sample. Those researchers who have examined the issue have done so from three perspectives. The first are those authors who have studied language development through observation of a child's language use in a naturalistic environment. Bloom (1970) used observation of a child's language in the home as the basis for a study of the development of semantic categories. The author then developed procedures for estimating the level of language acquisition based on semantic knowledge reflected in the child's spontaneous utterances. Lee (1966), Lee and Canter (1971), and Lee (1974) employed spontaneous language samples elicited in a clinical environment to determine levels of language acquisition based on syntactic and morphologic developmental sequences. Prutting and Kirchner (1983) observed children in naturalistic environments and developed guidelines for estimating levels of language acquisition according to an eclectic collection of pragmatic behaviors. The resultant Pragmatic Protocol allows for analyses of both verbal and nonverbal communicative acts. In all three of these assessment orientations spontaneous language sample analysis serves as the basis for determining and examining developmental sequences.

Lund and Duchan (1985), McLean and Snyder-McLean (1978),

Muma (1978; 1985), and Tyack and Gottsleben (1976) have also advocated the use of spontaneous language sampling as an assessment technique. These authors indicate that sample analysis provides valid and efficient profiles of a child's level of linguistic, social, and cognitive development.

Gallagher (1983) has stated that estimates of form, function, and use of language can be obtained from a representative sample of the child's language. Byrne (1978) suggested that a quantitative and qualitative description of the language employed by the child is the best technique for determining remedial strategies. Byrne indicated that examining language samples during the intervention process allows the speech-language pathologist to assess the child's progress in therapy.

As with any assessment procedure, the speech-language pathologist must be concerned with the validity of the language sample. Assuring the reliability and validity of a language sample has been the focus of research. The context in which the sample is elicited is one perspective from which validity has been addressed. Dollagan and Miller (1986), Emerick and Hatten (1979), and McLean and Snyder-McLean (1978) identify two variables which the speech-language pathologist can control to increase the validity of the elicitation procedure. They suggest that the material used, such as toys, be age and gender appropriate. Validity can be maintained by recording all of the child's responses, both verbal and nonverbal. In this

way the speech-language pathologist can assess the child's social and cognitive abilities in addition to language skills (McLean and Snyder-McLean, 1978). Emerick and Hatten (1978) suggest a procedure in which the clinician allows periods of silence to occur during elicitation. They recommend the use of open-ended questions or repeating the child's utterances to enhance production.

The procedure used to analyze the language sample should be consistent with the goals of assessment (Dollaghan and Miller, 1986). For example, the Developmental Sentence Score procedure (Lee and Canter, 1971), which analyzes syntactic and morphologic structures, would not be an appropriate analysis method for investigating a child's pragmatic skills.

Finally, the length of the language sample is important to the validity of results. A sample of 50-100 utterances is required by many language sample analysis procedures (Tyack and Gottsleben, 1976; Lee and Canter, 1971). All of the above authors concur that a standardization of elicitation procedures is necessary in order to insure the validity and reliability of any reassessment which is performed.

The context which the speech-language pathologist creates for elicitation of the language sample can affect the validity of the language sample. Longhurst and File (1977) studied four methods of eliciting language samples for use with the Developmental Sentence Score procedure. In eliciting the 50-100 utterance sample, the authors found

that engaging the child in conversation produced the highest DSS percentile scores for the subjects included in their study. Longhurst and File reported that engaging in play activities resulted in the second highest percentile scores for their subjects. The authors caution that play activities can result in a diminution of the child's production andso decrease the validity of the language sample.

Stalnaker and Creaghead (1982) elicited language samples from the subjects in their study and compared them for total number of utterances, percentage of sentence fragments, transformational and adverbial expansions, and semantic relations. Their results are similar to those of Longhurst and File reported above. Stalnaker and Creaghead found that a condition in which the child retold a story using props, such as pictures, resulted in the highest mean length of utterance. These authors found that playing with toys produced a similar quantity of utterances, but expressed the concern that the child may become too involved with the toys and limit verbalizations. The conclusion which can be drawn from both of these studies is that conversational methods of eliciting a language sample is an appropriate procedure for use in the assessment of a child's language.

Once a valid language sample has been elicited, the semantic/syntactic structures which the child exhibits can be compared with data on normal sequences of semantic, syntactic, and pragmatic acquisition. The results of this

comparison determines whether a need for remediation exists. If treatment is indicated, the goals of therapy are derived from the elicited language sample. Appropriate treatment goals and methods are specified. Following the prescribed course of treatment another language sample is elicited. This sample is evaluated for the presence or absence of treatment behaviors. In this manner the speech-language pathologist can determine both the effectiveness of therapy and subsequent treatment goals.

There are several important advantages of the language sample analysis technique. By examining the sample, the clinician can determine whether therapy is required. This is achieved based on a comparison of the child's language with normal sequences of development. Appropriate therapy goals can be advanced based on deficits which the child displays during the language-based interaction. Once a therapy cycle has been completed, the elicitation and evaluation of another language sample will indicate whether the child is using the newly acquired skills in everyday conversation or whether further intervention is warranted.

Danwitz (1981) determined that psychometric tests separate language skills into categories, thus reducing their validity and providing a distorted picture of a child's language. Danwitz supported the use of language sample analysis because sampling provides an accurate estimate of a child's language use. These samples can then be broken down in order to examine their constituent parts.

Similarly, Prutting, Gallagher, and Mulac (1978) compared the results obtained by subjects on the expressive portion of the Northwest Syntax Screening Test (Lee, 1969) and by analysis of a language sample. The authors found that the Northwestern Syntax Screening Test significantly underestimated the production abilities of the subjects. The authors determined that psychological factors inherent in the Northwestern Syntax Screening Test, factors which are not involved in expressive language performance, reduced that measure's validity. Prutting, et.al., suggested that analyses of spontaneous language samples elicited with pictures and open-ended questions were a more valid means of assessing a child's syntactic ability.

There exists, then, extensive support for the use of language sample analysis as a valid assessment procedure. Speech-language pathologists continue to ignore this technique for two reasons. First, language sample analysis is a time-consuming process which can decrease the number of language assessments which the clinician can perform. Language assessments are completed for the purpose of determining eligibility for services, and for prioritizing the service caseload. Federal legislation (PL 94-142) mandates the most appropriate educational placement for handicapped individuals. Services provided by speech-language pathologists are regulated by these guidelines (Douglas, 1983). Many speech-language pathologists rely on norm-referenced measures as assessment

procedures which can be administered and scored quickly and easily. Preschool and early school-aged clients fall into the age ranges allowed by many norm referenced tests. By using such measures as an integral part of the intervention paradigm, the speech-language pathologist is able to perform language assessments on an increased number of children.

In addition to assessment, the speech-language pathologist is responsible for organizing the service caseload (Pendergast, 1983). Often, this responsibility follows this cycle of events. Assessments are completed with the use of norm-referenced tests. The child achieves a certain score on this measure and the individual scores are then arranged according to performance. The most severe children receive top priority in the caseload. Presumably the speech-language pathologist will make every effort to include all children needing intervention in the service caseload. However, sheer numbers may at times make this task an impossibility. Once the caseload has been determined in this fashion, the speech-language pathologist will begin to develop appropriate therapy goals for each child, and will then commence therapy.

The difficulty in conforming the spontaneous language sample analysis technique to the time and caseload constraints faced by the speech-language pathologist is a dual problem. First is the issue of time. While it is true that a 50-100 utterance language sample may be elicited in a manageable amount of time, the time needed for syntactic,

semantic, morphologic, and pragmatic feature analysis, should such a total assessment be required, is most likely prohibitive. Even if the speech-language pathologist is interested only in a syntactic/morphologic analysis, the time needed to transcibe and analyze the language sample stretches available time limits.

An example of a procedure which can provide important diagnostic information is contained in a study which examined the linguistic analysis of spontaneous speech (Engler, Hannah, and Longhurst, 1977). The authors describe the analysis procedure as follows. A 50-100 utterance language sample is elicited from the child using picture stimulation. Once the sample has been transcribed and segmented into utterances, the authors suggest transferring the segments to individualized notecards. This procedure presumably allows the speech-language pathologist a more detailed look at the child's expressive language skills. Once the cards have been prepared, the sample is analyzed for a variety of structures, their presence or absence, or their correct or incorrect usage. The results are then compared to developmental sequences and the determination is made regarding intervention and appropriate therapy goals. To carry this process through the entire intervention cycle the speech-language pathologist will use the same pictures to elicit another language sample, follow the same card preparation procedure, and compare results with the previous language sample.

This procedure is impractical for most clinicians. Typical speech-language pathologists do not have the schedules which allow for extended, individualized assessments that this type of analysis would entail (Vetter, 1985). Clearly, should the speech-language pathologist desire to use spontaneous language sample analysis as the basis of assessment, an alternative method of analysis would need to be employed.

Not only is time a factor in the use of language samples in assessment, but the results which they supply may be undesirable. Typically, standardized scores from norm-referenced tests are the foundation upon which a service caseload is organized (Vetter, 1985). In school districts which employ severity rating scales to prioritize students in need of speech-language services, standardized test scores are often transformed via some formula into the severity rating. For example, the Test of Auditory Comprehension of Language - Revised Edition (Carrow, 1978) scoring manual provides a chart which allows the transformation of quotient scores to t-scores. The t-scores can then be applied to instruments such as the Blackhawk Severity Rating Scale (1984). In this manner, the speech-language pathologist can establish the caseload fairly quickly. On the other hand, language sample analysis results are often in the form of developmental sequences expressed in months or years and may not be readily adaptable to some severity rating scales. It would then be

the responsibility of the speech-language pathologist to provide a subjective description of severity. For the sake of accountability, many professionals prefer the objectivity of standardized scores and severity rating scales (Pendergast, 1983).

The problems regarding assessment validity may be summarized as follows. Researchers have warned about the dangers of relying too heavily on the use of decontextualized, norm-referenced tests during the intervention cycle. They have provided evidence suggesting that analyses of spontaneous language samples are a more valid tool. Speech-language pathologists must be concerned with accountability. Professionals recognize the prohibitive time factor in analyzing language samples and the unsuitability of developmental sequences for establishing service caseloads via severity rating scales.

A solution to this problem would be a sample analysis procedure which relies on spontaneous language samples for its information, yet supplies standardized scores applicable to severity rating scales. Such a procedure could be the Developmental Sentence Score developed by Lee and Canter (1971). The Developmental Sentence Score is based upon developmental sequences of syntactic and morphologic acquisition up to age six years, eleven months, and evaluates a variety of syntactic structures.

The Developmental Sentence Score was chosen as a language assessment procedure because it is a widely used

technique of spontaneous language sample analysis. The Developmental Sentence Score technique is appropriate for the intervention paradigm which has been described. A syntactic analysis based on the Developmental Sentence Score procedure is performed on a spontaneous language sample during assessment. The speech-language pathologist determines the need for treatment and/or goals for treatment based on the absence or incorrect use of a syntactic structure. Following an intervention cycle, a second language sample is elicited under conditions similar to the first in order to insure validity. This can indicate carryover of the targeted structure(s) into spontaneous speech. In addition, Lee and Canter have developed percentile scores which can be used as a guideline for determining the need for intervention. The authors also claim that the percentile scores can be used for evaluation of therapeutic progress. This is especially important when one considers the criticisms of norm-referenced tests as reassessment tools.

While spontaneous language sampling may increase the validity of language assessments, techniques such as the Developmental Sentence Score procedure are a time consuming process (Lee and Canter, 1971). A possible solution for reduction of the time needed to complete a manual language sample analysis is the application of computer technology. With increased use and availability of computers, researchers have begun to explore the variety of ways and

uses with which they can be implemented. Some authors have examined the application of computer technology to a wide range of clinical tasks within the field of speech-language pathology including record keeping, assessment, and research (Goldman and Dahle, 1985). Yet another author has completed a description of some recently available computer assisted language assessment tools (Schwartz, 1985). Since computer assisted assessment is one of the crucial aspects of this study, it would be valuable to briefly consider a summary of two of the programs detailed by Schwartz.

The first computer program to be discussed is Lingquest I, developed by Mordecai, Palin, and Palmer (1982). The program performs an analysis of spontaneous language samples for form, lexical structures, and verb tense. The procedure for use requires that in addition to what the child actually produced the clinician must enter simultaneously what he or she thought the child intended. From a comparison of the two sets of information, Lingquest I provides a quantitative lexical analysis which compares the number of times the child's elicited production matched the adult model. The drawback to the Lingquest I output is similar to a manual analysis of language samples, namely, that the speech-language pathologist will still need to refer to developmental sequences to determine whether intervention is required.

Subjectivity is reduced in the Systematic Analysis of Language Transcripts (SALT) (Miller and Chapman, 1983). In

this program, an analysis is performed on the elicited language sample which has been entered into the computer via the keyboard. There are three subprograms to SALT, two of which can be of great advantage to the speech-language pathologist. The clinician can program SALT to provide the frequency of occurrence of previously coded items within the transcript. Should the speech-language pathologist choose to examine the frequency with which a particular semantic relation occurs within the child's language, this structure can be coded and entered. The SALT program can also provide word lists that have been coded for structure and function. In this case, should the speech-language pathologist wish to examine the child's use of wh-question forms, this particular subprogram will select these structures from the entered sample and list them.

A third computer software program, and the one chosen for this study, is the Parrot Easy Language Sample Analysis (PELSA) (Weiner, 1985). This computer software was chosen because its reasonable price makes it accessible for most speech-language pathologists and because it provides two analyses of the language sample. The first of these is called a library search. In this subprogram of the PELSA, the language sample is analyzed according to grammatical categories such as auxilliaries, modals, interrogatives, and negatives. The second analysis available is called the code analysis. For this analysis, symbols are provided which are used to indicate correct or incorrect marking of

plurals, main verbs, regular and irregular past tense verb forms, and present progressive verb forms. Once the language sample has been typed into the computer the speech-language pathologist can choose which of these analyses will be performed. There are also additions available for the PELSA which allow an increase in the capacity of the library search and code analysis.

The PELSA provides both a qualitative and quantitative analysis of a child's spontaneously produced language sample. In addition to providing the actual corpus of the child's language, the PELSA provides the percentage of correct use of grammatical forms, as well as their frequency of occurrence. The PELSA also provides the speech-language pathologist with type-token ratio and mean length of utterance results.

An important issue to be addressed is whether a computer assisted language assessment is a time efficient diagnostic procedure. The value and validity of spontaneous language sample analysis as the foundation of an assessment-therpay-reassessment paradigm has been detailed. The basis of this study will be the results provided by each of three diagnostic procedures. The Preschool Language Scale has been chosen as the norm-referenced test because it is a widely used measure of expressive and receptive language skills. The Developmental Sentence Score procedure has been chosen as the traditional method of language assessment because it too is a widely used assessment

measure, it relies on a spontaneous language sample for its information base, and provides standardized scores which can be applied to severity rating scales used for developing service caseloads.

It has also been shown that computer assissted analyses of language samples can provide usable information for assessment, intervention, and reassessment purposes. The Parrot Easy Language Sample Analysis is the third diagnostic procedure to be used in this study, for reasons already detailed. The following questions will be addressed in this study: 1.) Can time management be effectively solved with the aid of computer assisted language sample analyses?; and 2.) Does a quantitative and qualitative difference exist between the usable information provided by each of the three types of assessment?

Methods

Subjects:

Sixteen children served as subjects in the present study. The subjects had a mean age of 4 years, 7 months, with an age range of three years, three months to six years, seven months. All subjects in the present study were subjectively judged by their parents to be of normal intelligence. The parents also judged their children to be developing language normally. Any child scoring one standard deviation below the mean on the Preschool Language Scale was not included in the study.

Subjects were selected from the general population of a midwestern college community. A letter (see Appendix A) requesting participation was sent to the homes of the children. Telephone contact was employed with some of the parents. The parents were asked to respond to the request for inclusion of their child in the study and to indicate which of the available times were acceptable. If alternative time arrangements were needed, this was accomplished by a telephone conversation between the experimenter and the parents.

Procedure:

The parent(s) were requested to accompany their child to the Speech-Language-Hearing Clinic on the campus of Eastern Illinois Univerity. Upon arrival, the parent(s) and child were greeted by the experimenter. Five minutes were provided for interaction between the experimenter, parent,

and child. During this time, the experimental procedure was reviewed and any parental questions answered. The experimenter requested the child accompany him to the therapy room which was used for the experiment. If the child experienced difficulty separating from the parent, the parent was allowed to accompany the child to the therapy room. The room had been arranged with appropriately sized table and chairs. A large area of the floor was kept clear as a play area. A Panasonic tape recorder was placed in the corner of the room to allow for audio taping of the experimental session. The room was equipped with a Javelin camera connected to a Panasonic video cassette recorder for videotaping of the session.

The experiment was composed of three sections. These included a free play section to establish rapport, administration of the Preschool Language Scale (Zimmerman, Steiner, and Pond, 1979), and elicitation of a spontaneous speech sample. All children participated in the rapport building activities first. Rapport was judged to have occurred following the child's use of ten spontaneous utterances. According to Lee's guidelines (Lee and Koenigschnecht, 1974), the ten utterances were counted but were not used as part of the language sample. The time required to elicit the ten spontaneous utterances was included as sampling time. Administration of the PLS or elicitation of the language sample was ordered through random assignment so that for eight subjects PLS

administration followed the rapport sesssion, and for eight subjects elicitation of the language sample followed the rapport session. A specified set of play materials which was kept constant across all experimental sessions and was used for establishing rapport and eliciting the language sample is located in Appendix B.

The administration time for the PLS was monitored and recorded by the experimenter during the session. Audio playback of the session was completed to insure the accuracy of this data. Elicitation of a language sample of at least 100 utterances was accomplished under one of three conditions. First, the child was asked to describe his house, family, neighborhood, school, or one activity that he or she particularly enjoyed. Second, the language sample was elicited during the play activities previously described. Third, pictures were provided of particular activities to elicit language from the child. In all three conditions, the clinician employed open-ended questions and allowed for moments of silence in order to facilitate elicitation of the language sample. The experimenter kept a cumulative count of the utterances during the session. When 100 utterances were reached, the elicitation procedures were discontinued. The time needed for elicitation was recorded, and again audio playback was used to insure the accuracy of the results.

At the end of the session the child was returned to the waiting area. If requested, preliminary test results

were provided to the parents. The parents were then thanked for allowing their child to take part in the study.

After the above data was collected, these procedures were followed. The Preschool Language Scale was scored. The time for administration and scoring was totaled and recorded for each child. The language sample was transcribed under two conditions. In the first condition the language sample was manually transcribed by one of two graduate clinicians. The graduate clinicians completed a training session. During the training sequence, the experimenter explained that sixty discrete utterances were needed. Discrete utterances were defined as subject responses to questions or initiation of conversation which occurred only once in the language sample. The graduate clinicians listened to an audio tape of the session and wrote the child's spontaneous utterances on a piece of paper. To insure reliability both clinicians were determined to have had prior experience transcribing language samples equivalent to the experimenter. The first language samples transcribed by the graduate clinicians were reviewed by the experimenter to insure that the proper procedures had been followed. The graduate clinicians calculated in minutes the time needed to elicit and transcribe the language sample. The language samples transcribed by the graduate clinicians were used exclusively for completion of the Developmental Sentence Score procedure. All DSS procedures were completed by the experimenter. The time needed for elicitation,

transcription, and analysis of the language sample was tabulated and recorded for each subject.

Under the second condition, the same audio-taped language sample was entered directly into the computer via the keyboard by the experimenter. Guidelines for the Parrot Easy Language Sample Analysis procedure were followed when entering the language sample. The time needed for elicitation, entering, and computer assisted analysis was totaled and recorded for each child. The result of the experimental session with each child was three pieces of information: 1) time needed for administration and scoring of the Preschool Language Scale; 2) time needed for elicitation, transcription, and analysis of a language sample using the DSS procedure; and 3) time needed for eliciting, entering, and analyzing a language sample using the PELSA procedure. The total time required for each condition was compared to determine the most time efficient method of performing a language assessment.

The quantity of information derived from each assessment procedure was compared to the amount of time needed to complete each assessment procedure. From the Preschool Language Scale, there are three primary pieces of information: an Auditory Comprehension Quotient, a Verbal Ability Quotient, and a Language Quotient. From the DSS, there is one piece of information, the percentile rank of the child. The amount of information gathered from the PELSA varies with the length of the language sample and the

syntactic forms which are present in the language sample. There can be no more than nineteen pieces of information available from the PELSA. These included percentage-correct scores for each of the sixteen forms analyzed by the program, a type-token ratio, a mean length of response, and a mean length of utterance.

The following statistics were performed on the data which was collected during the study. A one-way analysis of variance was performed to determine whether significant differences existed between the independent variables. The independent variables were defined as each of the assessment procedures: The Preschool Language Scale; the Developmental Sentence Score procedure; and the Parrot Easy Language Sample Analysis procedure. The dependent variable was the length of time needed to complete each procedure. Scheffe's Test (Shearer, 1982) was used as a post hoc comparison to specify differences among treatment means. The proportions test (Shearer, 1982) was used to determine if there were significant information per unit of time ratios among the three conditions.

Results:

The total number of minutes needed to complete each of the assessment procedures was the dependent variable measured to address the first research question. The type of analysis was the independent variable. For each subject, the time in minutes was calculated for administration and scoring of the Preschool Language Scale (PLS); elicitation, transcription, and analysis of a sixty - utterance language sample via the Developmental Sentence Score procedure (DSS); and eliciting, entering, and analyzing a sixty - utterance language sample using the Parrot Easy Language Sample Analysis procedure (PELSA).

A one - way analysis of variance indicated a significant main effect between the total time in minutes need to complete each of the three assessment procedures ($F = 38.9$; $p > .0001$). See Table 1 for the Table of Means; see Table 2 for the Analysis of Variance Summary Table.

Table 1

Table of Means of the Independent Variables

Test Group	Subject Count	Mean	Stan. Dev.	Stan. Error	Scores Min.	Max.	95% Conf.Int.for Mean
01 (PLS)	16	20.6	5.3	1.3	10	30	17.9 - 23.3
02 (DSS)	16	57.8	19.3	4.7	35	96	47.9 - 67.8
03 (PELSA)	16	41.1	7.3	1.8	25	52	37.4 - 44.9

Table 2

Analysis of Variance of the Independent Means

Source	D.F.	Sum of SQ	Mean SQ	F Ratio	F Prob
Between Groups	2	11826.4	5913.2	38.9	.000
Within Groups	48	7286.4	151.8		
Total	50	19112.8			

Post hoc analysis of the data using Scheffe's Test was completed to determine differences among the means of the independent variables. The Scheffe results indicated that the PLS took significantly less time to administer and score than the DSS procedure (x1 - x2 = 37.2 > 13.7; p = .01). The DSS procedure is defined as the elicitation, transcription, and analysis tasks. The PLS also took significantly less time to administer and score than the PELSA procedure (x1 - x3 = 20.5 > 13.7; p = .01). In addition, the PELSA procedure took significantly less time to complete than the DSS (x3 - x2 = 16.7 > 13.7; p = .01). See Table 3 for the Table of Scheffe.

Table 3

Table of Scheffe

Comparison	Difference	Critical Value	Sig. at .01
x1 - x2 (mean PLS - mean DSS)	37.2	13.7	.01*
x1 - x3 (mean PLS - mean PELSA)	20.5	13.7	.01*
x3 - x2 (mean PELSA - mean DSS)	16.7	13.7	.01*
x1 - x3a (mean PLS - factored mean PELSA)	12.3	13.7	.01

* = significant

An additional post hoc analysis using Scheffe's Test was completed to specify differences among the independent variables, with one alteration. The analysis time for the PELSA was factored out, meaning that only ythe time needed for eliciting and entering the language sample were totaled. This reduced the overall mean for the PELSA ($x3 = 33 < x3 = 41$). These results indicated that the PLS no longer took significantly less time to administer and score than completion of the PELSA procedure ($x1 - x3 = 12 < 13.7$; $p = .01$). All other relationships remained stable.

Proportion of information was the dependent variable derived to address the second research question. The total number of scores for each assessment procedure were totaled. These equalled three for the PLS; one for the DSS; and no more than nineteen for the PELSA. Proportion values were determined by dividing the number of scores obtained using each procedure by the number of minutes needed to complete each procedure. Again, the independent variables were the PLS, the DSS, and PELSA.

Proportion test results indicated that the PELSA provided significantly more information per minute than the PLS ($z = 3.1 > 2.56$; $p = .01$), and that the PELSA provided significantly more information per minute than the DSS ($z = 15.1 > 2.56$; $p = .01$). In addition, the PLS provided more information per minute than the DSS ($z = 3.6 > 2.56$; $p = .01$).

A post hoc analysis using the proportions test was

completed to address a research question posed after the data was collected. This additional comparison was used to determine if significant differences existed between the DSS and PELSA procedures when information per minute was calculated disregarding elicitation and transcription times and using only analysis times. The proportions test revealed that the PELSA analysis took significantly less time to complete than the DSS analysis ($z = 5.6 > 2.56$; $p = .01$)

Discussion

Time analysis results from this study reveal that the Preschool Language Scale (PLS) required significantly less time to administer and score than either of the language sample analysis procedures completed as part of this study. The difference between the means was greater for the PLS and Developmental Sentence Score (DSS) procedure than for the PLS and the Parrot Easy Language Sample Analysis (PELSA) procedure. Of the two language sample analysis procedures, the Parrot Easy Language Sample Analysis procedure required significantly less time to complete than the Developmental Sentence Score procedure. These results indicate that should a speech-language pathologist choose language sample analysis as part of a language assessment, the computer - assisted procedure will be significantly less time consuming than the traditional manual analysis of a language sample.

Results from this study also indicate that when analysis time for the computer program is not calculated into the total procedure time and only the time needed for eliciting and entering the samples is included, the PELSA does not require significantly more time to complete than the PLS. This suggests that a computer program which analyzes spontaneous language samples could serve as the primary assessment procedure, as opposed to serving as an adjunct to a norm-referenced test.

This conclusion is supported by results which indicate that the PELSA provided significantly more information per minute than either of the traditional assessment measures. This data is determined by dividing the amount of information provided by each procedure by the time in minutes needed to collect that information. This difference between the PELSA and traditional assessment procedures is greater when only elicitation and entering times are calculated. Exclusion of the analysis time must be considered because once the language sample has been entered into the computer and the analysis initiated, the speech language - pathologist is free to tend to other tasks. Taken together, these time results suggest that it is feasible that computer assisted language sample analysis procedures could be routinely completed as a primarly language assessment method.

There are ways in which the time needed to complete computer assisted language sample analyses can be further reduced. The effects of discounting computer program analysis time on the results of this study have already been stated. Eliciting language samples from more than one child at a time could further reduce the time needed to complete language assessments using analysis procedures. Some research suggests that a child's language production is enhanced by peer interaction (Muma, 1978). Further standardization of the methods and materials which are employed in eliciting the sample could also help reduce

overall assessment time.

To this point, the discussion has centered on the quantity of information that can be achieved in a given amount of time. Also addressed have been ways to further reduce that amount of time. A speech-language pathologist would be concerned not only with the quantity of information, but also its quality. The quality of information which an assessment procedure provides is a subjective judgement which will largely depend on the purpose of the diagnostic. A comparison of the kind of results achieved with the DSS and PELSA procedures can help clarify this issue. Both analyses provide syntactic and morphological information and so are fairly easy to compare. The results from this study indicate that the PELSA takes significantly less time to complete and provides more information per unit of time than the DSS. The percentage scores resulting from the PELSA may be used to indicate where a problem exists. The percentile rank provided by the DSS may be used to determine whether or not a problem exists If the goal of the assessment is only to determine whether a child is delayed in his or her syntactic development, then the DSS can be said to provide a better quality of information, since it specifically answers this question.

It is a rare occasion, however, that a speech-language pathologist is interested only in whether or not a problem exists. The purpose of a language assessment is to

determine the nature and extent of any language delay, disorder, or difference which may exist. The increase in the quantity of information that a computer assisted language sample analysis program can achieve has already been detailed. The quality of a language assessment would be enhanced by a computer software program which indicates whether a problem exists and then details the nature of that problem.

Increasing the performance capacity of existing software packages is a method which can enhance the quality and quantity of information achieved during a language assessment. In the user's manual for the PELSA, Weiner (1985) states that accessories to the current program which increase analysis capabilities are available. The accessories are programmed to analyze, for example, the semantic content of a language sample. Further additions to a software package might include analysis of nonverbal behaviors for the purpose of making a pragmatic assessment. The net result of increased analysis capacity would be an increase in a program's ability to provide diagnostic information of high quality in a time-efficient manner.

Integrating increased-capacity language analysis programs with other, currently existing software packages may further enhance the quality of an assessment by increasing the amount of information achieved and enhancing time - management capabilities. Interfacing a computer program such as the PELSA with the Computer - Assisted

Assessment of Phonological Processes (Hodson, 1985) would provide a thorough description of a child's speech skills. Combining the power of these assessment programs with software designed to generate individualized education programs would lessen even further the amount of time spent preparing for therapy.

Further modifications in computer software may be developed to enhance the quality of a language assessment. Programs which hierarchically arrange test results could be integrated into an assessment software package. Data processing programs, such as the Lotus 1-2-3, possess the capacity to arrange data in this fashion. A software package such as the PELSA could be programmed to hierarchically arrange the results from the analysis of a number of language samples. This would reduce the time needed to determine those children who possess more severe deficits, which would in turn make caseload decisions easier to complete.

Computer programs which yield severity ratings based on language sample analyses would further improve the quality of the assessment procedure. The previously mentioned Computer Assisted Assessment of Phonological Processes provides a severity rating on the sample which has been analyzed. A severity rating could be achieved with the PELSA, with the rating based on the percentage scores which result from the analysis of the language sample. The PELSA could be further modified to provide severity ratings on a

number of language samples which have been analyzed. These results could be listed in an hierarchical manner. Further integration with other software could yield a severity rating based on results from more than one analysis procedure. All test results could then be applied to a software package which analyzes the severity ratings and provides appropriate therapy goals. All of these methods serve to reduce the amount of time spent on assessment and enhance the quality of that assessment.

The results from this study indicate that computer assisted programs can play a primary role in the assessment of a child's language. Integration of various software packages can positively affect the quantity and quality of information which is achieved during the assessment. Several directions for future research are indicated by these findings. Further research needs to be completed on existing programs to improve the quality of information and increase information per unit of time ratios. The PELSA, for example, contains a problem area which varies the amount of information which the analysis provides. If the language sample exceeds 300 words, the PELSA will provide the sixteen analysis tables and the Summary Table with the composite of these results. It will not provide either the type - token ratio or the mean length of utterance. If the sample exceeds 500 total words, the sixteen analysis tables will not be included in the computer printout. Similar language sample analysis programs need to be

examined to determine whether similar problems exist. Analysis capacity would be an important variable in any modifications which are attempted on existing software programs.

Reliability and validity of the scores that are achieved on computer analysis programs need further attention. The PELSA, for example, provides percent - correct scores in each of sixteen categories. Norms need to be developed which allow the speech - language pathologist to determine what is meant by "75% correct use of plural forms." How many examples or plural forms are needed to insure that a child has integrated this structure into everyday language? This type of information is essential before any integration with severity rating scales is attempted.

Further research could be completed in the area of cost effectiveness. An assessment using only computer software could be completed, and the length of time needed for this process could be compared to the length of time needed to complete a traditional, manual assessment. These two procedures could then be compared to determine which is the most cost effective, based again on quantity and quality of information. The results of this and other research could only serve to further clarify the future role of computer software programs in the field of speech - language pathology.

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Appendix A
Parental Letter and Request for Permission Form

July 15, 1987

Dear Parent or Guardian:

For the completion of my Master's Thesis in the Department of Communication Disorders and Sciences at Eastern Illinois University, I am conducting research that requires an analysis of language in children aged three years to six years, eleven months. Procedures for the research are as follows:

1. To qualify for the research project, your child's birthdate must fall between June 1, 1984, and August 30, 1980.

2. You will accompany your child to the Speech-Language-Hearing Clinic on the campus of Eastern Illinois University. The Clinic is located on the second floor of the Clinical Services Building at the corner of 7th and Hayes Streets in Charleston, IL.

3. At the beginning of your scheduled appointment, I will introduce myself to both you and your child. I will spend five to ten minutes conversing with you in order to allow your child time to become comfortable with the environment. Your child will participate in a language assessment which will take approximately one hour. The language assessment will be composed of two parts. The first will be administration of a language test which is a typical picture-pointing and question/response assessment. The second part will be elicitaion of a sample of conversational speech. This will be accomplished with the use of toys and pictures. Your child's performance will be audiotaped and videotaped for later analysis

At the end of your appointment, I will be available to review your child's performance.

This project is not designed to provide your child with any special services; nor will it interfere with any services your child may currently be receiving. There is no risk to your child for participating in this study. I will not use your child's name in any report of the research results.

I am available to answer any questions you may have regarding your child's involvement in this research. My home telephone number is (217) 348-5080.

I freely and voluntarily consent for my child to participate in the research project entitled, "A Comparison of Norm-Referenced, Traditional, and Computer-Assisted Language Assessments," conducted by Michel Helmke, Graduate Student, Department of Communication Disorders and Sciences, Eastern Illinois University, Charleston, IL.

Parent Signature:_____

Address:_____

Home Phone:_____Work Phone:_____

Return signed forms in the enclosed stamped, self-addressed envelope. Should you misplace the envelope, address correspondence to: Department of Communication Disorders, Eastern Illinois University, Charleston, IL 61920. ATTN: Michel Helmke. As soon as I receive your signed consent form, I will call you regarding an appointment time.

Sincerely,

Michel Helmke, B.S.
Graduate Candidate

Robert M. Augustine, Ph.D.
Thesis Chairperson

Appendix B

List of Standardized Paly Material

Play-School Farm and Animals

Pink Panther and Friends Color-forms

Wuzzles Color-forms

Super Heroes Color-forms

GI Joe Color-forms

Cinderella Picture Book (Walt Disney Productions)

Record Form

Revised Edition

rla Lee Zimmerman, Violette G. Steiner, & Roberta Evatt Pond

Materials needed to administer test:

Preschool Language Scale manual
Preschool Language Scale picture book
12 1" colored blocks in box (red, yellow, blue, green, orange, purple)
Small piece of coarse sandpaper
Set of coins: half-dollar, quarter, dime, nickel, penny
Watch or clock with second hand

Auditory Comprehension:

Point Score 30 AC Age 4-9 (57) ACQ 136

Verbal Ability:

Point Score 23 VA Age 3-10½ (46½) VAQ 110

Language Age ~~Age~~ LQ 123

$\frac{AC + VA}{2}$ = LA 4-3 $\frac{ACQ + VAQ}{2}$ = LQ

Name HEATHER

School _____

Teacher _____

Parent or guardian _____

City _____ State _____

Examiner _____

Yr. Mo. Day

Date administered _____

Birthdate _____

Chronological age _____

Charles E. Merrill Publishing Co.
A Bell & Howell Company
Columbus, Ohio 43216

8261-7

Section and Age	Sensory Discrimination	Logical Thinking	Grammar and Vocabulary	Memory and Attention Span	Perceptual Spatial Relations	Self Image
Sec I 1–1½ yrs.	2 3		1 3 4	2 4	1 4	3
Sec II 1½–2 yrs	5 6 7	6	5 6 7 8	8	8	7
Sec III 2–2½ yrs	10 11 12	9 10 11	10 11	12	12	11
Sec IV 2½–3 yrs	13 15 16	15 16	13 14 15 16		14	13 15
Sec V 3–3½ yrs	18 19 20	18 19 20	18	20	17	17
Sec VI 3½–4 yrs.	21 23 24	21 23 24	22 23 24		22	24
Sec VII 4–4½ yrs	25 28	25 27 28	26 28	27	26	26
Sec VIII 4½–5 yrs	30 31	31	31 32	30	29	29 31 32
Sec IX 5–6 yrs	35	34 35 36	33 35	36	33	33
Sec X 6–7 yrs.	38 39	39 40	37	38 39 40	37	37

Section and Age	Sensory Discrimination	Logical Thinking	Grammar and Vocabulary	Memory and Attention Span	Perceptual Spatial Relations	Self Image
Sec I 1–1½ yrs	1	2	1 2 3 4	1 3 4		2
Sec II 1½–2 yrs	6		5 6 7 8	5 6		7 8
Sec III 2–2½ yrs	9 10 11 12		10 11	9 10 11 12		
Sec IV 2½–3 yrs	13	14 15	14 16	13 16		15 16
Sec V 3–3½ yrs	20	18 19	17	18 20		17 19
Sec VI 3½–4 yrs	21 23	22 23	21 22	21 24		23
Sec VII 4–4½ yrs	25 27	26 28	26 28	25		27 28
Sec VIII 4½–5 yrs	29 31 32	30	29 30	29 30 32		31
Sec IX 5–6 yrs	33 36	34	34	33 34 36	35	35
Sec X 6–7 yrs	37 40	38	38 40	37 39 40	39	39

Appendix C
PELSA Summary Table

SUMMARY TABLE

[GRAMMATICAL FORM	PERCENTAGE CORRECT]
[AUXILIARIES	33]
[MODALS	100]
[INTERROGATIVES (YES/NO & WH)	100]
[NEGATIVES	100]
[DEMONSTRATIVES & LOCATIVES	100]
[PRONOUNS	95]
[ARTICLES & CONJUNCTIONS	100]
[POSSESSIVES	---]
[COMPARATIVES & SUPERLATIVES	---]
[COPULA (BE)	100]
[PREPOSITIONS	89]
[MAIN VERBS	89]
[PRESENT PROGRESSIVE	81]
[SIMPLE PAST TENSE	NOT]
[IRREGULAR PAST TENSE	80]
[PLURALS	100]

Appendix C
DSS Analysis Form

Name: 7.
Clinician:

Date:
B.D.:
C.A.:
DSS: 7.7/25th

Developmental Sentence Score Form

Sentence	Indef Prof	Pers Pro	Prim Verb	Sec Verb	Neg	Conj	Inter	Wh-Q	Sen	Total
[illegible]		1								1
[illegible]	1		1						1	3
[illegible]	1,1		1						1	4
[illegible]	1,1		1						1	4
[illegible]	3	1	1						1	6
[illegible]	2,7		2						1	12
[illegible]	7									7
[illegible]	3,7	2	1						1	15
[illegible]		1,2	1							5
[illegible]	7	1,2	1,2						1	14
[illegible]		1	2		1				1	5
[illegible]		1,1	2							4
[illegible]		1,1	2,2						1	7
[illegible]		1,2,2	2,2							10
[illegible]		1	2						1	4
[illegible]		1,1	2						1	5
[illegible]		1	1						1	3
[illegible]	3,3	1,1	1,1			3			1	14
[illegible]	1	3	1						1	6
[illegible]	3,3	1,1,1	1,1						1	12