A Comparison of the Time Taken to Administer and Analyze Phonologic and Phonetic Tests

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Recommended Citation

Alexander, Beverly, "A Comparison of the Time Taken to Administer and Analyze Phonologic and Phonetic Tests" (1989). *Dissertations and Theses.* Paper 3854.
https://doi.org/10.15760/etd.5738

AN ABSTRACT OF THE THESIS OF BEVERLY ALEXANDER for the
Master of Science in Communication presented May 9, 1989.

Title: A Comparison of the Time Taken to Administer and
          Analyze Phonologic and Phonetic Tests.

APPROVED BY MEMBERS OF THE THESIS COMMITTEE:

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In the past, many public school speech-language
pathologists have verbalized that phonological process
assessments are too time-consuming for those with large
caseloads. If a phonological assessment tool can be shown
to take approximately the same amount of time as a typical
phonetic analysis, then perhaps public school speech-
language pathologists would analyze and treat their
phonologically-impaired clients using a more appropriate
phonological approach instead of a less effective phonetic

approach. The main postulation of using a phonological process-based approach is that remediation time is saved because generalization occurs across the entire process when only a few sound errors are treated.

In reviewing the literature, statistical comparisons between the time it takes to complete (administer and analyze) a phonological analysis and the time it takes to complete a phonetic analysis were not found. This lack of data lead to the development of this study, which was undertaken in order to determine the accuracy of the clinician's perceptions that a phonologic process assessment is more time-consuming than a phonetic assessment. The phonologic process tests used in this study were the Assessment of Phonological Processes-Revised (APP) (Hodson, 1986) which was analyzed by the Computer Analysis of Phonological Processes (CAPP) (Hodson, 1985) and the Khan-Lewis Phonological Analysis (KLPA) (Khan & Lewis, 1986). The phonetic tests used in this study were the Goldman Fristoe Test of Articulation (GFTA) (Goldman & Fristoe, 1986) and the Photo Articulation Test (PAT) (Pendergast, Dickey, Selmar, & Soder, 1969).

The purpose of this study was to determine if the time it takes to complete a phonological test was significantly different than the time it takes to complete a phonetic test. It was hoped this study would identify an instrument that the public school speech-language

pathologist could use more effectively and efficiently to analyze phonologically-impaired children.

Twelve subjects, ages 4-1 to 6-7 years with mild, moderate, or severe phonologic and/or phonetic disorders participated in this study. Five speech-language pathology students who had experienced at least two speech and hearing clinics at PSU, were selected as examiners for this study.

The mean ($\bar{x}$) and standard deviation (S.D.) of the completion time of each test used in this study were calculated and are as follows: APP as analyzed by the APP (APP/CAPP): $\bar{x}$ = 22:56, S.D. 3:29; the KLPA with the transcription time from the GFTA Sound-in-Words Subtest: $\bar{x}$ = 43:14, S.D. = 11:56; the KLPA without transcription time from the GFTA Sounds-in-Words Subtest: $\bar{x}$ = 37:26, S.D. = 11:01; the GFTA: $\bar{x}$ = 26:13, S.D. = 4:05; the PAT: $\bar{x}$ = 11:27, S.D. = 2:04. Two-tailed t-tests for dependent means were used to compare the two phonological tests with the two phonetic tests. The study revealed that each comparison was significantly different beyond the .05 level of confidence. The APP/CAPP takes significantly less time to complete than the GFTA. The PAT takes significantly less time to complete than the APP/CAPP and the KLPA. The GFTA takes significantly less time to complete than the KLPA. Additionally, the phonological tests were compared with each other and the results revealed that the APP takes

significantly less time to complete than the KLPA.

The data also revealed that the more severe the child's speech sound disorder, the more time needed to complete the test. Although the number of subjects that participated in this study is limited, information gathered might be helpful in demonstrating that there are phonologic tests, such as the APP/CAPP, which are less time-consuming than some frequently used phonetic tests, such as the GFTA.

A COMPARISON OF THE TIME TAKEN TO ADMINISTER

AND ANALYZE PHONOLOGIC AND PHONETIC TESTS

by

BEVERLY ALEXANDER

A thesis submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE
in
SPEECH COMMUNICATION:
SPEECH AND HEARING SCIENCE

Portland State University

1989

TO THE OFFICE OF GRADUATE STUDIES:

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ACKNOWLEDGEMENTS

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CHAPTER I

INTRODUCTION AND STATEMENT OF PURPOSE

INTRODUCTION

Many experts in the area of speech sound disorders
stress the need to consider phonological processes, as well
as individual phonemes, when assessing children with
articulation disorders (Dunn & Barron, 1982; Edwards, 1983;
Hodson & Paden, 1983). This emphasis is directed toward
improving the efficiency and effectiveness of remediation,
but some speech-language pathologists are still not using a
phonological process approach in the assessment and/or
remediation process. Schwartz (1988) administered a survey
regarding phonological processes to public school
speech-language pathologists in Oregon, and found that 51%
contended that phonologic process analysis is too
time-consuming to be used in the public schools.

It is well known that many public school
speech-language pathologists are overly burdened with large
caseloads and must use their management time wisely. If a
phonological assessment tool that takes approximately the
same amount of time as a typical phonetic analysis can be
utilized, then perhaps public school speech-language
pathologists will begin to analyze and treat their

phonologically impaired clients using a more appropriate phonological approach instead of a less effective phonetic approach.

The Assessment of Phonological Processes-Revised (APP) (Hodson, 1986) uses 50 3-dimensional objects to elicit spontaneously produced, one-word responses for assessment. It is one of the faster phonological tests to administer, but analysis of the transcribed results is quite time-consuming (Weiss, Gordon, & Lillywhite, 1987). In 1985, Hodson published a computer program called Computer Analysis of Phonological Processes (CAPP) for the purpose of saving clinicians time in analyzing the APP.

The Khan-Lewis Phonological Analysis (KLPA) (Khan & Lewis, 1985) is another widely-used phonological process assessment tool. It is designed to be used with the responses obtained on the Goldman-Fristoe Test of Articulation (GFTA) (Goldman & Fristoe, 1986). The responses from the test can be analyzed for phonetic and phonologic errors, the latter through the KLPA analysis form.

From this researcher's experience, the KLPA requires much more time to analyze than other articulation assessments. However, a benefit of using the KLPA with the GFTA is the clinician can do a phonetic analysis as well as a phonologic analysis when only one test is administered.

As with many diagnostic tests, when a shorter and

quicker version is used, less information results when
compared to a longer, more thorough test (Andrews & Fey,
1986; Dyson & Robinson, 1987). A time-consuming analysis
is not realistic for the public school speech-language
pathologist who needs to develop a large number of
individualized educational plans within a short period of
time. Speech-language pathologists may also need to submit
standardarized test results to prove the existence of an
articulation disorder (Klein, 1984). The perceived problem
of a phonological process assessment being too
time-consuming raised the following purpose statement and
experimental question.

STATEMENT OF PURPOSE

The purpose of this study was to determine if the
time it takes to administer and analyze (complete) a
phonological test is significantly different than the time
it takes to complete a phonetic test. Specifically, the
APP as analyzed by the CAPP, (APP/CAPP) and the KLPA were
compared with the Photo Articulation Test (PAT)
(Pendergast, Dickey, Selmar, & Soder, 1969) and the GFTA.

Hence, this study sought to answer the following
question: Is the time it takes to complete phonological
assessments, i.e., APP/CAPP and KLPA significantly
different than the completion time of phonetic tests, i.e.,
PAT and GFTA? This in turn led to the following null

hypotheses: The completion time of the APP/CAPP and/or the KLPA is not significantly different than the completion time of the GFTA and/or the PAT. Additionally a corollary question was asked: Is the time it takes to complete the APP/CAPP significantly different than the completion time of the KLPA? The purpose of answering these questions was to identify an instrument that the public school speech-language pathologist can use more effectively and efficiently to analyze phonologically disordered children in the limited amount of time available to them.

DEFINITION OF TERMS

The following definitions were utilized throughout this study.

Phonetic Assessment/Analysis: phonemic assessment which describes phonetic errors in terms of omission, substitutions, and distortions; each speech sound is analyzed according to its position (initial, medial, and final) (Weiss, Gordon, & Lillywhite, 1987).

Phonetic Disorder/Impairment: occurs when a child has not learned the correct motor movements required to achieve acceptable productions of speech sounds (Schwartz, 1983).

Phonologic Assessment/Analysis: speech sound assessment which describes errors according to phonological patterns or processes. "These error patterns frequently affect entire sound classes, particular sound sequences, or the

syllable structure of the word" (Bernthal & Bankson, 1988, p.265)

Phonologic Disorder/Impairment: occurs when a child has not learned the correct linguistic rules required to achieve acceptable productions of speech sounds (Schwartz, 1983).

Phonologic Processes: describe the alterations between the sounds actually produced and the adult target production (Weiss et al., 1987).

Speech Sound Disorder/Impairment: occurs when a child produces speech sound errors not typically present in their normally developing peer group (Schwartz, 1983).

The following acronyms will be utilized throughout this study. This list will give the reader a quick reference guide of unfamiliar acronyms used.

APP: Assessment of Phonologic Processes-Revised (Hodson, 1986); an articulation test which is used to assess phonologic errors.

APP/CAPP: Assessment of Phonologic Processes (Hodson, 1986) analyzed by the Computer Assessment of Phonological Processes (Hodson, 1985).

CAPP: Computer Assessment of Phonological Processes (Hodson, 1985); a computer program which analyzes results from the APP.

GFTA: Goldman-Fristoe Test of Articulation (Goldman & Fristoe, 1986); an articulation test which is used to assess phonetic errors.

KLPA: <u>Khan-Lewis Phonological Analysis</u> (Khan & Lewis, 1986); an articulation test which analyzes phonologic errors.

NPA: <u>Natural Process Analysis</u> (Shriberg & Kwiatkowski, 1980); an articulation test which is used to assess phonologic errors.

PAT: <u>Photo Articulation Test</u> (Pendergast et al., 1969); an articulation test which is used to assess phonetic errors.

PPACL: <u>Procedures for the Phonological Analysis of Children's Language</u> (Ingram, 1981); an articulation test which is used to assess phonologic errors.

For definitions of phonological process terms, refer to Appendices A and B.

CHAPTER II

REVIEW OF THE LITERATURE

Phonologic process analysis and phonetic analysis are the two main approaches used by speech-language pathologists for assessing speech sound disorders. This chapter will begin by discussing the basic differences between these two approaches and the history behind the controversy of describing speech sound disorders. The administration and analysis times of tests being used in this study and other time-saving phonological process assessments will then be considered, followed by a discussion of the reliability and validity of the KLPA and the APP.

PHONETIC VERSUS PHONOLOGIC APPROACH

There are distinct differences between phonetic and phonologic approaches. Below is a discussion of the differences.

Phonetic Approach

One of the earliest approaches for treating and assessing speech sound disorders, and still commonly used today, is the "traditional" approach developed by Van Riper

in the 1950's (Elbert & Geirut, 1986). This phonetic approach is a phonemic assessment which describes phonetic errors in terms of omissions, substitutions, and distortions; each speech sound is analyzed according to its position (initial, medial, and final) in the word (Weiss et al., 1987).

Schwartz (1983) described a phonetic error as an organic deviancy which effects the motor ability to produce a sound of speech because there are limitations of the person's speech mechanism. Bernthal and Bankson (1988) explained that phonetic errors occur because the "ability to produce a target sound is not within the person's repertoire of motor skills" (p.3). Phonetic errors usually have an organic cause, e.g., cleft palate, hearing impairment, and neurological disturbances (Schwartz, 1983), but can also be associated with unknown or nonorganic sources (Weiss et al., 1987). Phonetic errors are generally consistently produced, i.e., they are seldom, if ever, produced correctly in any position, e.g., /s/ is always misarticulated in the initial, medial, and final position in all words containing /s/ (Paul, 1988). Examples of phonetic analysis tests commonly used today include the Arizona Articulation Proficiency Scale (Fudala, 1970), the Developmental Articulation Test (Hejna, 1963), the GFTA, the PAT, and the Templin-Darley Tests of Articulation, (Templin & Darley, 1969). Remediation of

phonetic disorders should probably focus on the actual motor production of the speech sounds (Paul, 1988).

Phonologic Approach

The most recent approach to the assessment of speech sound disorders, which was developed in the late 1960's, is phonological process analysis. This interest in assessing speech sound disorders according to phonological processes is credited to Stampe (Elbert, Dinnsen, & Weismer, 1984). This phonologic approach is a speech sound assessment which describes errors according to phonological patterns or processes (See appendices A & B for examples of some of these processes). These patterns or processes are errors that occur when a child has not learned the correct linguistic rules required to achieve acceptable productions of speech sounds (Schwartz, 1983). "These error patterns frequently affect entire sound classes, particular sound sequences, or the syllable structure of the word" according to Bernthal and Bankson (1988; p. 265).

Phonological errors are usually due to "functional" causes. They are inconsistently produced depending on linguistic context and quality of other sounds surrounding the error sound. They are patterned errors, e.g., the error could occur across back consonants (Schwartz, 1983), and the misarticulation is usually easier to generate than the adult target sound (Weiss et al., 1987). These

children are much more likely to have a combined language disorder. The idea of identifying children's systematic speech sound error patterns by phonological process analysis has resulted in many assessment manuals (Elbert et al., 1984), including the APP, KLPA, <u>Natural Process Analysis</u> (NPA) (Shriberg & Kwiatkowski, 1980), <u>Phonological Process Analysis</u> (PPA) (Weiner, 1979), and <u>Procedures for the Phonological Analysis of Children's Language</u> (PPACL) (Ingram, 1981).

Remediation for these children should probably focus more on the phonologic process used in error to facilitate the emergence of new sound patterns rather than the actual motor movement of the individual speech sound (Compton, 1976; Paul, 1988).

The main postulation of using a phonological process-based approach in treating children with a speech sound disorder is that remediation is maximized due to the generalization which occurs across the entire process when only a few sound errors from the specific process are treated (Compton, 1976). Many studies have been completed which support this remediation approach (Crary & Hunt, 1983; Dunn & Barron, 1982; Elbert, 1983; Hodson, 1983; Tyler, Edwards, & Saxman, 1987).

Hence, by using a phonological process approach in remediation, time would be saved because generalization occurs across the entire process when only a few sound

errors are treated. Although there have been no empirical data to support this hypothesis (Tyler et al., 1987) many researchers (Edwards, 1983; Hodson & Paden, 1983; & Tyler et al., 1987) support the idea that it can save remediation time. This postulation gives additional support to this study. If a child is assessed using a phonological process analysis and thus treated using a phonological approach, then time could be saved during treatment.

Which Term Should Be Used?

There is some confusion in the labeling of speech sound errors because both phonetic and phonologic errors have been described by more than one name, and at times have been given more than one meaning. Bernthal and Bankson (1988) explained that the motorically based errors have been labeled phonetic errors and/or articulation errors. The "cognitively or linguistically-based" errors have been termed phonological errors and/or phonemic errors.

Shriberg (1986) attempted to clarify some of this confusion by explaining the history of these terms (Figure 1). The word dyslalia, which is defined as "defective articulation due to faulty learning or to abnormality of the external speech organs and not to lesions of the central or peripheral nervous system" (Wood, 1971, p. 86) was replaced with the label, articulation, approximately in the year 1920.

The word articulation was used for all speech sound disorders between 1920 to 1970. In the 1970's, a second method of analyzing speech sound disorders was introduced. This method analyzed the errors phonologically or according to their linguistic base. This new analysis procedure created some controversial issues. Clinicians questioned the efficiency of this lengthy and complex analysis as well as whether children could actually be analyzed more accurately using this procedure. At that point, articulation was the main term utilized to describe speech sound errors (Shriberg, 1986).

Beginning in the 1980's, the term phonology was becoming a more widely utilized term. This was possibly

ARTICULATION <u>VS</u> PHONOLOGY
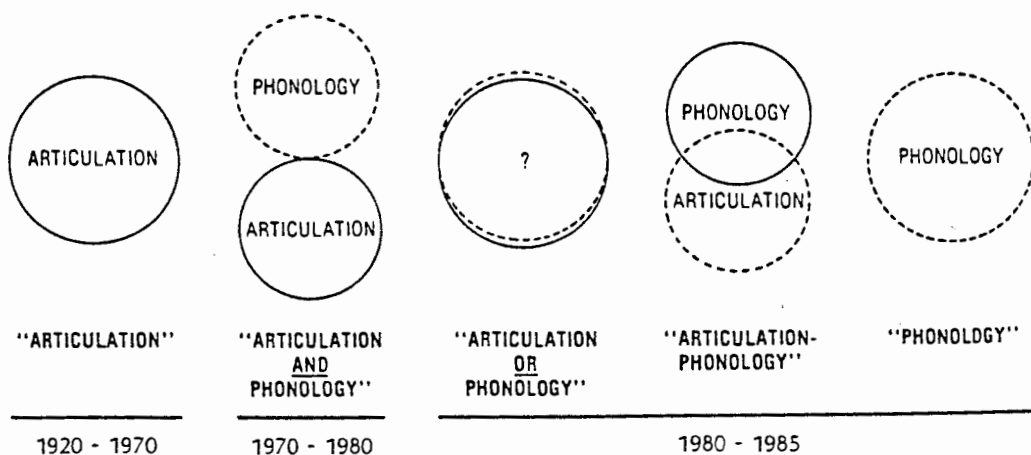
Figure 1. Alternative views of the terms "articulation" disorders versus "phonologic" disorders. (From: Shriberg, L.: Programs to Examine Phonetic and Phonologic Evaluation Records, University of Wisconsin, Software Development and Distribution Center, 1986, p. 11).

due to the increase of its presence in the literature, the education of future clinicians, and possibly because of the increase in the availability of phonological analysis procedures (Shriberg, 1986).

Presently, some clinicians continue to use the two terms synonomously, which is shown in Figure 1 by the circles with the question mark. Others recognize three speech sound disorders, the two primary disorders and a third which is a combination of both (shown by the overlapping area). The solid line around the term phonology versus the dotted line around articulation signifies that this term now appears more frequently in the literature as headings and chapter titles (Shriberg, 1986).

The last symbol to the far right, in Figure 1, suggests the possiblity that the term "phonology" is a better word than "articulation," when discussing the general topic of speech sound disorders. The dotted line, around the word "phonology," signifies that "relevant terminological issues are, to date, unresolved" (Shriberg, 1986, p. 13).

TIME CONSIDERATIONS OF SPEECH SOUND TESTS

In reviewing the literature, statistical comparisons between the time it takes to analyze and administer a phonological analysis and the time it takes to analyze and administer a phonetic analysis were not

found. Although there seemingly have been no comparative studies completed, test manuals and articles do estimate the approximate time required to administer and score the tests being used in this study, but most authors did not give specific data on how many subjects were timed nor the examiner's qualifications.

Pendergast et al. (1969) stated the PAT, a phonetic analysis test, takes approximately 5 minutes to administer, but they do not specify the analysis time. Weiss et al. (1987) reported that the entire procedure takes approximately 20 minutes. Goldman and Fristoe (1986) did not list the administration or the analysis times of the GFTA. Weiss et al. (1987) reported that the adminstration time is approximately 20 minutes, and Bernthal and Bankson (1988) stated it takes 10 to 12 minutes to administer. None of the authors gave an estimation of the analysis time nor conditions of the timing.

In looking at phonological tests, Hodson (1986) reported the APP takes 15 to 20 minutes to administer and the analysis takes 30 minutes. She also reported that an experienced clinician with good phonetic skills can complete the entire procedure in less than one hour. Hodson (1985) stated that by using the CAPP program to analyze the APP, the analysis time is decreased to 10 minutes. Paden and Moss (1985) calculated the mean time required to complete the PPACL (a subtest only), the NPA,

and the APP. The results indicated the PPACL subtest takes 3 hours and 46 minutes; the NPA, 2 hours and 1 minute; and the APP, 59 minutes. The only examiner qualifications specified were that they must have thoroughly familiarized themselves with the three tests prior to giving them. Since the APP took the least amount of time, these results indicate a reason for it to be one of the most desirable phonological tests when considering the factor of efficiency.

Khan and Lewis (1986) reported that the KLPA, phonological process test, takes 15 to 40 minutes "to complete". They do not describe any of the conditions present in obtaining this time estimate.

As can be seen from the above reports, most of the times for test administration and analysis were approximated or not reported. Additionally no data were provided as to the number of subjects timed, severity of the subjects, or the qualifications of the examiner.

OTHER TIME SAVING PROCEDURES

Some researchers have recognized the need for a less time-consuming phonological process assessment for the public school speech-language pathologist. Klein (1984) suggested a step-by-step procedure which converts the results from any "popular" articulation test (i.e., phonetic analysis) into a phonological processes analysis.

This six-step procedure is an attempt to reduce the time it takes to administer and analyze a phonological assessment, and a way to use a traditional test for a phonological process analysis. This is accomplished by the evaluation of each consonant in every test word by charting each attempt of a consonant target within the Model and Replica chart (Figure 2). The chart displays the consonants elicited from an articulation test according to word position, place, and manner of articulation. Target consonants for English are represented by the symbol given in the upper left corner of each box as shown in Figure 2. The Model and Replica Charts are used as a preliminary analysis. Since the one-word test eliminates the need to administer an additional phonological test, it appears to be a time-efficient means for assessing children with phonologically impaired processes, but the time it saves has never been determined.

Garn-Nunn (1986) developed a procedure to save time by administering conventional articulation tests and analyzing them phonologically. Each test is fully transcribed and then every process affecting any test-word phoneme is identified. This procedure saves time because it is not necessary to administer an additional phonological test, but the author implied time is not saved during analysis and the clinician needs to be very familiar

Figure 2. Model and Replica Chart (From Klein, B.: Language, Speech, and Hearing Services in Schools, 15, p. 270).

with phonological processes.

Shriberg and Kwiatkowski (1980) also developed a procedure which was time-saving when compared to their earlier procedures. In their procedure, they suggest analyzing a 200-225 word language sample in order to obtain 90 intelligible words to be analyzed for eight naturally occurring processes. Appropriate forms and worksheets are included in the monograph to aid in the analysis. The procedure and worksheets help save time compared to an analysis of a language sample which would analyze many more processes. When seven students were timed in transcribing and analyzing the same tape, the range of time needed to complete the entire procedure was 1 hour, 30 minutes to 3 hours, 30 minutes (Shriberg & Kwiatkowski, 1980). This would be an unacceptable time allotment for the public school speech-language pathologist. It could be expected that the time to complete the procedure would decrease as the clinician became more familiar with the process. They further reported that experienced clinicians complete the procedure within approximately 1 hour, 40 minutes which still appears to be fairly lengthy.

There have been other computer programs besides the CAPP developed to help the clinician save time, such as the Programs to Examine Phonetic and Phonologic Evaluation Records (PEPPER) (Shriberg, 1986).

VALIDITY AND RELIABILITY OF THE APP AND THE KLPA

The advantages of a phonological process analysis of a continuous speech sample over one-word elicited response analysis have been documented (Shriberg & Kwiatkowski, 1980). The validity, however, of one-word phonological assessment has been shown through several studies which compared one-word response tests (e.g., the APP and KLPA) to analysis of spontaneous speech samples. Most of the researchers found that one-word response analyses of phonological processes can be just as effective in determining initial phonological remediation targets as a spontaneous speech sample, but most of them indicated that in order to obtain a thorough phonological analysis, a spontaneous language sample should also be analyzed (Andrews & Fey, 1986; Benjamin & Greenwood, 1983; Dyson & Robinson, 1987; Klein, 1984; Paden & Moss, 1985). Conversely, others have stressed that a more efficient means (such as one-word response tests) of assessing phonologically-impaired children is needed in order to be practical in time-constrained situations (Klein, 1984; Garn-Nunn, 1986).

Vailidity of the APP

Although the APP is not standardized, many phonological process specialists who have studied it consider it to be a reliable means of evaluating

phonological processes in disordered children (Andrews & Fey, 1986; Benjamin & Greenwood, 1983; Dyson & Robinson, 1987; Paden & Moss, 1985).

Andrews and Fey (1986) completed a study which compared the spontaneous words from the APP to words obtained in a spontaneous speech sample and found the sampling condition made no difference in the severity level determined for each child. They did not compare each individual process to determine if they were significantly different.

Benjamin and Greenwood (1983) compared procedures of the APP, PPACL (modified), and the Phonological Process Protocol (Khan & Lewis, 1982), which is an experimental version of the KLPA. They determined the percent of occurrence for five different phonological processes strongly correlated among the three tests.

Paden and Moss (1985) compared the NPA, the APP, and the PPACL. They reported that "essentially similar" processes were identified when comparing all three procedures. Original plans for this study were to involve eight children with severely disordered phonology, but due to unintelligibility and thus inability of the clinician to transcribe a spontaneous speech sample, only three children were analyzed. They further suggested, if a child is severely unintelligible, a one-word response format may be the most realistic way to obtain an assessment.

Dyson and Robinson (1987) also found similar results when comparing the NPA, APP, and the PPACL. Generally they found that the initial remediation targets were the same regardless of which assessment procedure was used.

Although the APP has not been standardized at this time, procedures have been undertaken to begin obtaining data for its standardization (Griffith, 1987). Overall the literature indicates the APP and/or a one-word phonological analysis is just as effective in determining initial phonological remediation targets as a spontaneous speech sample. It also indicates the APP is one of the quicker tests used to determine these targets.

This researcher has not found any studies which dealt with the issue of whether the CAPP results are significantly different from manual analysis; however, the developers of the CAPP meant for it to be used strictly as a supplement to a thorough manual analysis. Since the APP is one of the quicker phonological assessments and the use of the CAPP has been shown to decrease the analysis time tremendously (Hodson, 1985), then it is possible that the time it takes to complete this procedure will be shorter or will not be significantly different than the time it takes to complete the GFTA and/or the PAT.

Reliability and Validity of the KLPA

The KLPA is another widely used phonological process assessment tool. It was designed to analyze

phonologically the responses obtained from the Sounds-in-Words Subtest of the GFTA (a phonetic analysis). This assessment tool makes it possible for the clinician to administer only one test and obtain both a phonetic, as well as a phonologic analysis. In other words, if clinicians test children for phonetic errors by using the GFTA and then realize the children need a phonologic assessment, the clinicians do not need to re-test the children, but can analyze the same responses by using the KLPA. Additionally, if the clinicians only want a phonological analysis and do not want to complete a phonetic analysis, they can simply administer the Sounds-in-Words Subtest of the GFTA and analyze this subtest with the KLPA analysis form.

The KLPA is a standardized assessment tool. A total of 852 children reflecting U. S. population in sex, geography, and ethnic affiliation between the ages of 2-0 and 5-11 were used to develop normative data. This occurred in 7 states and 41 sites.

Reliability of the KLPA. Khan and Lewis (1986) reported three types of reliability for the KLPA. They include short-term test re-test, long-term test-retest, and interrater. The average short-term reliability coefficient was very high for both the speech simplification rating (.90) and the composite score (.96).

The long term reliability of the KLPA was completed

by retesting 51 children one year after the initial
standardization. "The standardized difference (average
difference divided by standard deviation) is .31 for the
speech simplification rating and .85 for the composite
score" (Khan & Lewis, 1986, p. 32). However, the authors
stress that these "two variables cannot be directly
compared" because the speech simplification rating is an
"age-referenced normative variable," and thus the composite
score would have a greater change (over a year) than the
speech simplification rating.

In order to determine the interrater reliabilty, 30
children were evaluated by 2 different raters. This
revealed a very high coefficient for both the speech
simplification rating (.97) and the composite score (.97).

Validity of the KLPA. Construct validity and content
validity were both reported on the KLPA (Khan & Lewis,
1986). The construct validity was supported by
developmental changes, profiles of scores for children with
speech disorders, interrelationships among the phonological
processes, internal consistency of the test, and
correlations with articulation tests. The authors
reported, "The decrease of mean raw scores from one age to
the next provides ample support for the construct that
individual and overall process usage is age related" (p.
34). .

Content validity was provided by the large number of

opportunities for phonological processes to be produced in the consonants contained in the target words. The KLPA provides between 6 and 44 opportunities to produce each of the 15 KLPA phonological processes.

The KLPA appears to be a reliable and valid phonological assessment tool. Bernthal and Bankson (1988) stated "(KLPA) test data reported in the manual are probably the most complete data available on children's use of phonological processes based on a closed set of stimulus words" (p. 239).

SUMMARY

A number of phonetic, as well as phonologic, assessment approaches exist. The differences between the two main types of assessments have been documented, as well as the need to treat specific children individually according to their phonetic, phonologic, or mixed disorder. Although phonetic approaches appear to be quicker to administer and analyze, this may not be the most effective way to treat the children, especially if they have phonologic errors and not phonetic errors. Even though some phonological process assessments are quite time-consuming to administer, others are less lengthy. Since time constraint is one of the more frequent complaints of public school speech-language pathologists when referring to phonological process assessments, this

study was completed in order to determine if a less
time-consuming, as well as possibly more effective
approach, for assessing phonological processes was
available.

CHAPTER III

METHODS AND PROCEDURES

METHODS

Subjects

Twelve children were selected from a pool of
potential subjects from clinical files at the Portland
State University (PSU) Speech and Hearing Clinic and from
speech-language pathology referrals. Only those with
signed parental release forms were considered for inclusion
in the study (see Appendix C). The 12 subjects ranged from
4-1 to 6-7 years of age. In addition, all subjects
selected met the following criteria:

1. hearing within normal limits in one ear based
on an audiometric screening test, given within one week of
the study, for the frequencies of 500, 1000, 2000, and 4000
Hz at 25 dB HL (re: ANSI 1969);

2. ability to be conditioned to each test given,
which was judged subjectively by the examiner giving the
test;

3. no known organic disorder or structural
deficit which might contribute to a speech sound disorder
based on information in the child's clinic file and/or
parent report;

4.   diagnosed with a mild, moderate, or severe articulation/phonology disorder based on information obtained from the testing for this study.

Examiners

Five speech-language pathology students enrolled in the PSU Speech and Hearing Sciences Program were selected as examiners for this study. They met the following criteria:

1.   had given each speech sound disorder test used in this study at least one time and no more than five times,

2.   had completed at least two PSU Speech and Hearing Sciences clinics prior to participating in this study.

Before participating in this study, the examiners completed a questionnaire regarding their experiences with the administration of each test used in this experiment (Appendix D). They also completed a 30-minute training session which included a review of the administration, analysis, and timing procedures for the experimental tests (Appendices E & F).

Measurement Instruments

The hearing screening instrument used in this investigation was the Beltone Portable Audiometer. It is a wide range audiometer that utilizes the frequency range of

125-8000 Hz. A TDK super dynamic 90-minute audio cassette tape was used to record the subjects' responses. A Panasonic audio tape recorder was used to record the responses and an Advance digital quartz stop watch was used to time the administration and analysis of the tests.

Experimental Tests

The experimental tests used in this study included the APP, CAPP, GFTA, KLPA, and PAT.

APP. The APP is designed to assess the usage of selected phonological processes. The words are spontaneously produced by the children as they choose and name three-dimensional objects which are set before them. The transcribed utterances are examined to identify deviations between the testees' productions and the adult target forms. These errors are described according to the type of phonological process deviation exhibited. The complete test elicits 50 words and analyzes 35 processes (Appendix G).

CAPP. The CAPP (Hodson, 1985) is a computer program which is designed to evaluate the responses obtained from the APP. The computer program formulates a phonological analysis summary which includes pattern deviations, the percentage of occurrence of each pattern, the average of phonological processes used by the testee, a phonological deviancy score, a severity interval, and a list of

suggested phonological processes to use in remediation.
(Appendix H shows a sample of a completed CAPP analysis.)
Phonological process deviations analyzed by the CAPP
include syllable reduction, prevocalic singleton omission,
postvocalic singleton omission, consonant sequence
reduction, strident deviation, velar deviation, liquid (l)
and liquid (r) deviations, nasal deviation, and glide
deviation (Appendix A).

GFTA. The GFTA is composed of three subtests,
including the Sounds-in-Words Subtest, the Stimulability
Subtest, and the Sounds-in-Sentences Subtest. The
Sounds-in-Words Subtest is designed to assess an
individual's production of consonant sounds in initial,
medial, and final positions in words. The words in this
subtest are elicited by instructing the child to name the
presented pictures. The Stimulability Subtest assesses the
stimulability of each misarticulated phoneme in syllables,
words, and sentences. The Sounds-in-Sentences Subtest
assesses speech sound production in a spontaneous manner.
The words are elicited by reading two stories to the child
and then instructing the child to re-tell the story by
using the pictures as memory aids. The test consists of 44
colored pictures on easel presentation, two picture stories
to elicit words in context, a manual, and a response form.

KLPA. The KLPA is designed to supplement the
diagnostic information given in the GFTA. The 44 words

elicited by the GFTA on the Sounds-in-Words Subtest are transcribed onto the KLPA analysis sheet where the responses are analyzed for the use of 15 phonological processes (Appendix B). Of these 15 processes, 12 are characteristic of normal speech development. They include: deletion of final consonants, initial voicing, syllable reduction, palatal fronting, deaffrication, velar fronting, consonant harmony, stridency deletion, stopping of fricatives and affricates, cluster simplification, final devoicing, and liquid simplification. Of the 15 processes, 3 are nondevelopmental, including: deletion of initial consonants, glottal replacement, and backing to velars.

PAT. The PAT consists of 72 colored photographs. The test is designed to evaluate the production of consonants, vowels, and dipthongs. The last 3 pictures test connected speech. The child is instructed to name the picture to which the examiner points.

The speech sound disorder tests mentioned above were chosen for this experiment because the GFTA and the PAT are widely used by speech-language pathologists, the KLPA is used in association with the GFTA, and the APP/CAPP appears to be the fastest method of obtaining a phonological assessement.

<div align="center">PROCEDURES</div>

Setting

All screening and testing was conducted in quiet, well-lit rooms in the PSU Speech and Hearing Clinic. The subjects were examined one at a time. Each child was given a 5-minute break after each test had been administered and/or between subtests if the child was showing signs of restlessness.

Screening Procedures

The subjects' files were screened to determine their appropriateness for this study. The screening began with review of clinical records and/or interview with the speech-language pathologist familiar with the child. This was completed to determine if the child had been diagnosed or was suspected to have a phonological/articulation disorder. If the subject met this qualification, a puretone hearing screening test was completed to determine normal hearing levels. The children who passed the screening were considered as potential subjects.

Potential subjects who were not diagnosed as having a mild, moderate, or severe phonological/articulation disorder, and/or unable to condition to any one of the tests given, were not selected as subjects for this study.

Examiner's Procedures

The APP, the GFTA, and the PAT were administered to

the subjects in one session by the examiners. Four examiners each tested two children and one examiner tested four children.

The procedures for administering and scoring the PAT, the GFTA, and the KLPA were followed as instructed in their respective manuals. The APP was administered as instructed in the manual and analyzed by using the CAPP as instructed in the CAPP manual.

The order of test administration was varied (see Table I). This procedure was followed to help counterbalance factors such as child fatigue and/or child-clinician familiarity which could have affected the time needed to administer the tests.

Timing Procedures

Each clinician timed the administration of each test separately. The timing began when the clinician and child were in their seats and immediately prior to the clinician giving the instructions to the child. The time it took to set up the materials was not included. The timing stopped immediatley after the clinician administered the last test item to the child. In order to obtain an administration time of the KLPA, the examiner separately recorded the time it took to administer the Sounds-in-Words Subtest of the GFTA. Each examiner was given written instructions on the timing procedures to be used (Appendix F). In addition to

TABLE I

ORDER OF THREE TESTS ADMINISTERED

		Tests		
		Goldman-Fristoe Test of Articulation	Photo Artic- ulation Test	Assessment of Phonological Processes
Examiner Number	Subject Number			
1	1	first	second	third
	2	third	first	second
	3	second	third	first
	4	first	second	third
2	5	third	first	second
	6	second	third	first
3	7	first	second	third
	8	third	first	second
4	9	second	third	first
	10	first	second	third
5	11	third	first	second
	12	second	third	first

the examiners' timing their own administration of the test,
this researcher timed each clinicians' first subject tested
to insure accurate timing procedures. Each session was
also tape-recorded to allow re-timing of the tests if
errors were made in the timing procedures during the
testing.

The analysis of each test was timed individually by
each clinician. Each examiner was observed during the
analysis of their first subject's results, by this
researcher, in order to insure that each examiner was
following the correct timing procedures. The test results
were analyzed within 6 weeks from the time of the
administration of the tests. The analysis of the KLPA,
PAT, and GFTA was completed in a well-lit, quiet room. The
analysis of the APP was completed in the PSU Computer Lab.
The timing of the analysis of each test began when the
clinician had assembled all materials needed to analyze the
tests. The timing of each test was completed when the
clinician was satisfied that all results had been
calculated. Each clinician was given a form to record the
times they had obtained (Appendix I).

DATA MEASUREMENT AND ANALYSIS

The administration time and the analysis time for
each test was individually recorded. The completion time
of each testing procedure was calculated from which means,

standard deviations, and ranges were determined for each speech sound test studied. In order to determine if the mean completion times of each of the phonologic tests (APP/CAPP and/or KLPA) was significantly different than the mean completion times for each of the phonetic tests (PAT and the GFTA), a two-tailed t-test for dependent means was calculated. Additionally mean completion times of the APP and the KLPA were compared by a two-tailed t-test for dependent means. An alpha level of .05 was set for determining statistical significance. For ancillary information, the mean completion times for each severity level (mild, moderate, and severe) was calculated to determine if the child's severity level influenced the amount of time needed to complete the test.

CHAPTER IV

RESULTS AND DISCUSSION

RESULTS

The stated purpose of this study was to determine if the time it takes to administer and analyze a phonological test is significantly different than the time it takes to administer and analyze a phonetic test. Specifically, the APP/CAPP and the KLPA were compared with the PAT and the GFTA.

The first question posed was: Is the time it takes to administer and analyze phonological assessments, i.e., APP and KLPA significantly different than the administration and analysis time of phonetic tests, i.e., PAT and GFTA? The answer to this question varies depending on the tests being compared. Appendix J presents the raw data and Table II shows the means, standard deviations, and ranges of time for each test, in addition to $\underline{t}$-test comparisons of the administration and analysis times of the phonological versus phonetic tests. All $\underline{t}$-test comparisons of phonological versus phonetic tests revealed a significant difference beyond the .05 level of confidence. The APP/CAPP ($\overline{X}$ = 22:56; SD = 3:29) took significantly less time to administer and analyze than the GFTA ($\overline{X}$ = 26:13;

TABLE II

MEANS, STANDARD DEVIATIONS, RANGES, AND t-TEST COMPARISONS
FOR PHONOLOGIC VERSUS PHONETIC
COMPLETION TIMES

TIME (minutes: seconds)

TEST COMPARISONS	MEAN	S.D.	RANGES	t-values
APP/CAPP	22:56	3:29	17:20 to 27:35	
				9.943**
PAT	11:27	2:04	7:48 to 15:36	(df = 11)
APP/CAPP	22:56	3:29	17:20 to 27:35	
				-2.206*
GFTA	26:13	4:05	18:35 to 32:21	(df = 11)
KLPA (without transcription)	37:26	11:01	22:11 to 53:01	
				8.826**
PAT	11:27	2:04	7:48 to 15:36	(df = 11)
KLPA (without transcription)	37:26	11:01	22:11 to 53:01	
				4.424**
GFTA	26:13	4:05	18:35 to 32:21	(df = 11)
KLPA (with transcription)	43:14	11:56	25:24 to 60:41	
				9.953**
PAT	11:27	2:04	7:48 to 15:36	(df = 11)
KLPA (with transcription)	43:14	11:56	25:24 to 60:41	
				6.169**
GFTA	26:13	4:05	18:35 to 32:21	(df = 11)

*   significant beyond .05 level of confidence
** significant beyond .001 level of confidence

SD = 4:05) and the APP/CAPP took significantly more time than the PAT ($\overline{x}$ = 11:27; SD = 2:04).

The timing of the KLPA was recorded in two different ways because the KLPA results can be transcribed from the GFTA Sounds-in-Words subtest (KLPA with transcription) or it can be administered soley and the results written directly onto the KLPA response form (KLPA without transcription). The KLPA with transcription ($\overline{x}$ = 43:14; SD = 11:56) took significantly more time than the GFTA and the PAT. The administration and analysis time of the KLPA without transcription ($\overline{x}$ = 37:26; SD = 11:01) also took significantly more time than both the GFTA and the PAT.

The corollary question asked was: Is the time it takes to complete the APP/CAPP significantly different than the completion time of the KLPA? The results from this study indicated it took much less time to complete APP/CAPP than both the KLPA with transcription and the KLPA without the transcription time added (Table III).

DISCUSSION

This investigator sought to determine if the perception of clinicians regarding the extra time needed to assess phonologically-impaired children was accurate. The data from this study revealed that the APP/CAPP, a phonologic test, is more time-efficient than the GFTA, a phonetic test (Table II). In the other comparisons, the

TABLE III

MEANS, STANDARD DEVIATIONS, RANGES, AND t-TEST COMPARISONS
FOR THE APP/CAPP VERSUS THE KLPA
COMPLETION TIMES

TIME (minutes: seconds)

TEST COMPARISONS	MEAN	S.D.	RANGES	t-values
APP/CAPP	22:56	3:29	17:20 to 27:35	-4.38**
KLPA (without transcription)	37:26	11:01	22:11 to 53:01	(df = 11)
APP/CAPP	22:56	3:29	17:20 to 27:35	-5.688***
KLPA (with transcription)	43:14	11:56	25:24 to 60:41	(df = 11)

** significant beyond .01 level of confidence
*** significant beyond .001 level of confidence

phonologic tests required more time to complete than the
phonetic tests.

Additional information obtained from the results of
this study indicated the length of time it takes to
complete a phonologic or phonetic test increases as the
severity level of the child's speech sound disorder
increases. This observation can be seen in Figure 3.

Advantages and Disadvantages of Assessment Tools

Depending on a client's severity level, and/or the
clinician's theoretical background, the clinician might
want to administer a phonetic analysis, a phonologic
analysis, or both. The amount of time it takes to
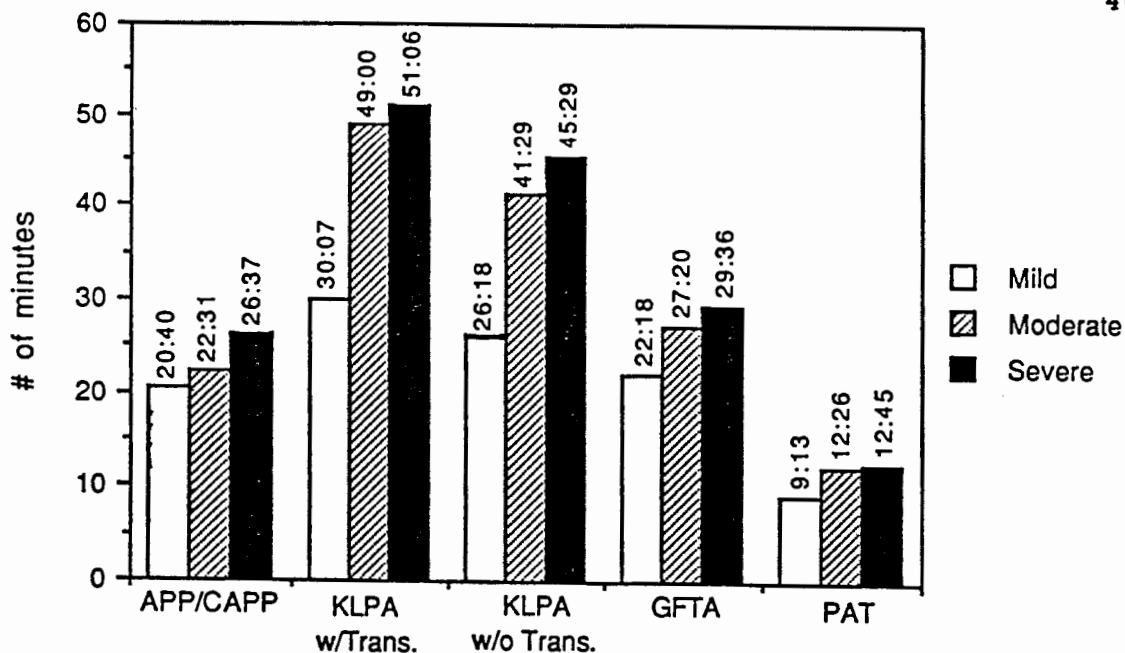
Figure 3. Mean Completion Times According to the Child's Severity Level.

administer and analyze a test generally plays a large part in the busy clinician's decision of which test/tests to administer. Other attributes which also are considered when deciding which test to administer include amount of information obtained from analyzing the test, initial cost, maintenance cost, reliability, validity, and availability and/or convenience of the test. By examining these attributes in conjunction with time efficiency of each test, clinicians can choose the most efficient and/or suitable test for their needs. Table IV lists each of these qualities and rates them positively or negatively for each individual test used in this study. These attributes as related to the four tests in this study will be explained further.

TABLE IV

POSITIVE AND NEGATIVE ATTRIBUTES OF TESTS

Attributes	Phonologic Tests		Phonetic Tests	
	CAPP/APP	KLPA	GFTA	PAT
Time Efficiency	+	−	+	+
Amount of Information Obtained	+	+	+	−
Initial Cost	−	−	−	+
Maintenance Cost	+	−	+	+
Reliability	−	+	+	+
Validity	+	+	+	+
Availability/ Convenience	−	+	+	+

Time Efficiency. According to the results of this study, the PAT, a phonetic test, would be the test of choice if the examiner were choosing a phonetic/phonologic test soley based on time efficiency. Pendergast et al. (1969) stated the PAT takes less than 5 minutes to complete. The results from this study found the mean time to complete the PAT was 11:27 with a range of 7:48 to 15:36 (Table II). The time it takes to complete the PAT is minimal compared to other tests and therefore this attribute receives a positive rating.

The APP/CAPP, a phonologic assessment tool, was the second most time-efficient test used in this study ($\overline{x}$ = 22:56). Hodson (1985, 1986) reported the APP/CAPP takes from 25 to 30 minutes to complete. In the present study the time obtained for the lower range (17:20) and the time obtained for the higher range (27:35) was slightly less than the higher and lower ranges reported by Hodson (1985, 1986). Since this was found to be one of the least time-consuming tests in this study, it receives a positive rating in this category.

Goldman and Fristoe (1986) did not report the administration or analysis times of the GFTA, a phonetic test. Weiss et al. (1987) reported that the adminstration time is approximately 20 minutes and Bernthal and Bankson (1988) stated it takes 10 to 12 minutes to administer. Neither author gave an estimation of the analysis time nor

conditions of the timing. This study found that it took a range of 15:49 to 24:27 to administer the GFTA, which is similar to the time suggested by Weiss et al. (1987), but is slightly longer than the time suggested by Bernthal and Bankson (1988). In this study the mean completion time of the GFTA was 26:13 with a range of 18:35 to 32:21. Although this amount of time is longer than the time it took to complete the PAT and the APP/CAPP, this author judges that this is still a reasonable allotment of time needed to complete a thorough speech sound analysis, so the GFTA receives a positive rating for this attribute.

According to Khan and Lewis (1986), it takes 15 to 40 minutes "to complete" the KLPA, a phonologic test, although they do not describe any of the conditions present in obtaining this time estimate. The times obtained in this study were longer than those described in the KLPA manual. The KLPA without transcription took a mean time of 37:26 with a range time of 22:11 to 53:01, while the KLPA with transcription took a mean time of 43:14 with a range of 25:24 to 60:41. Since these times are considerably longer than the other three tests and might be slightly unreasonable for a busy clinician, a negative rating is given to the KLPA in this category.

Amount of Information Obtained. An examiner possibly obtains more information from the KLPA, a phonologic test, than from any of the other tests discussed. Scoring the

KLPA yields a composite score, percentile rank, a speech simplification rating, and an age equivalent score. The goal selection worksheet yields a phonological remediation guide, which gives suggestions on which processes to target and a phonetic inventory, which allows the clinician to see whether the client's phonetic repertoire is limited in some way (Khan & Lewis, 1986). The KLPA receives a positive rating in this category.

Information obtained from completing the APP/CAPP, a phonologic assessment tool, includes percentage of occurrence of ten phonologic process pattern deviations, the phonological deviancy score, the severity level, and patterns which should be targeted for remediation (Appendix E). If the examiner needed information on additional processes, a manual analysis of the APP, which assesses 30 processes, could be completed. Although a manual analysis of the APP yields information on 20 more processes, it will take the examiner much longer to analyze. The APP/CAPP yields a large amount of pertinent information needed to begin remediation and therefore it receives a positive rating in this category.

Scoring the GFTA, a phonetic test, yields percentile ranks for the word level and for syllable stimulability. This test allows the examiner to assess production of sounds in the initial, medial, and final positions for imitated syllables, spontaneous words, and spontaneous

sentences. Additionally, the responses from the Sounds-in-Words subtest can be analyzed phonologically on a KLPA response form. The GFTA is rated positive for this attribute.

Even though the PAT, a phonetic test, is the best choice for time efficiency, the amount of information obtained appears to be the least of all tests studied. Although this test includes transparent age-appropriate overlays which allow the examiner to compare visually "the subject's articulation errors with norms," the only score provided is that obtained by counting the number of errors (Pendergast et al., 1969). Compared to the other tests used, the PAT yielded minimal information and therefore receives a negative rating in this category.

Initial Cost. The cost of the PAT is $44.95 for the test booklet and 96 additional recording sheets (Interstate Printers & Publishers (IPP), (1989). It is the least expensive test in this study and receives a positive rating for initial cost.

The cost of the KLPA kit is $42.50, which includes a manual, 25 analysis forms, and a folder (American Guidance Service (AGS), 1989). However, in order to administer the KLPA, the examiner must also have the GFTA easel booklet which contains pictures to elicit the child's responses. This booklet is $62 (AGS, 1989). The total initial cost of the KLPA is over $100 and over twice as much as the PAT;

therefore, the KLPA receives a negative rating in this category.

According to the AGS (1989) the cost of the entire GFTA kit is $75, which includes an easel-type test, a manual, and 25 response forms. This cost appears to be fairly expensive compared to the PAT and therefore receives a negative rating in this category.

The initial cost for the APP, as used in this study, is $19.95 for 48 recording forms (Appendix D) and a manual. The test also requires three-dimensional objects/toys which are not provided in the kit. If the clinician is resourceful, the objects can cost as little as a few dollars. Although the initial cost of the APP is relatively minimal, the CAPP program, which is compatible with Apple computers (and in 1989, IMB computers) is $85. Since the initial cost for the APP/CAPP is greater than $100 and more expensive than the other tools mentioned, a negative rating is given.

Maintenance Cost. Once the clinician has invested in the initial cost of the APP/CAPP, GFTA, or the PAT, maintenance costs are very minimal. The only additional costs would probably be the purchase of more recording forms. They cost $5 for 48 forms, $9.50 for 28 forms, and $5 for 96 forms, respectively. All three of these tests receive a positive rating in this category.

The maintenance cost of the KLPA is the most expensive of the four assessment tools studied. The analysis forms are color-coded and very detailed and cost $28.75 for 28 forms. The KLPA receives a negative rating in this category.

Reliability / Validity. Bernthal and Bankson (1988) stated "The test data reported in the (KLPA) manual are probably the most complete data available on children's use of phonological processes based on a closed set of stimulus words" (p. 239). (See Chapter II for more information on the reliability and validity of the KLPA.) Both of these categories receive a positive rating due to the thorough research data provided by Khan and Lewis (1986).

Goldman and Fristoe (1986) reported test-retest, inter-rater, and intra-rater reliability. The range of the test-retest reliability for the 3 subtests was very high (.91 to .95). For the Sounds-in-Words subtest the inter-rater reliability (.92) and the intra-rater reliability (.91) was also very high. The validity of the GFTA was shown by using content validity. Both categories receive a positive rating.

Pendergast et al. (1969) reported test-retest reliability for the PAT as very high (.99). They reported criterion-related validity by comparing it to the Bryngelson-Glaspey and the Templin-Darley, with correlations of .974 (very high) and .815 (high),

respectively. The number of different types of reliability and validity reported on the PAT is limited compared to the GFTA and the KLPA, but the validity and the reliability is reported to be high to very high and thus both attributes receive a positive rating.

As mentioned earlier in chapter II, the APP/CAPP, is not standardized (although present standardization is underway). The test has been found to be valid (see Chapter II) and thus this category receives a positive rating. It has not been reported to be reliable therefore this category receives a negative rating.

Availability/Convenience. The KLPA and GFTA can be readily obtained from AGS (1989). Their manuals and tests can be easily transported from site to site due to their relatively small size. This attribute of the KLPA and GFTA recieves a positive rating.

The PAT can be easily ordered through IPP (1989). The test consists of 72 colored photographs with 9 pictures on each page and a manual which are both conveniently contained in a spiral-type book which can be transported easily. Due to the above-mentioned characteristics, this attribute of the PAT is rated as positive.

The APP/CAPP can readily be ordered through IPP (1989), but collecting the 3-dimensional objects can be inconvenient and carrying them from site to site can be awkward. Additionally, the need to use a computer to

analyze the data may be inconvenient. The APP/CAPP receives a negative rating in this category.

Concluding Remarks

Although time efficiency is an important test attribute in the busy clinician's decision of which speech sound assesment tool to administer, there are also additional factors to incorporate into the choice. If the clinician chooses a test soley based upon time efficiency, then the PAT would be the test of choice for a phonetic assessment, but it appears to yield the least amount of information. Although the APP/CAPP is the most time-efficient phonologic test and it additionally yields a large amount of information, it is not standardized. Both of these tests, as well as other tests, have undesirable characteristics as well as desirable characteristics (Table IV). When choosing an assessment test, all of the attributes need to be considered in order to obtain the most efficient and effective assessment tool from which the clinician can implement efficient and effective remediation.

CHAPTER V

SUMMARY AND IMPLICATIONS

SUMMARY

In the past, many public school speech-language pathologists have verbalized that phonological process assessments are too time-consuming for those who are overly burdened with large caseloads. If a phonological assessment tool can be shown to take approximately the same amount of time as a typical phonetic analysis, then perhaps public school speech-language pathologists would analyze and treat their phonologically-impaired clients using a more appropriate phonological approach instead of a less effective phonetic approach. The main postulation of using a phonological process-based approach is that remediation time is saved because generalization occurs across the entire process when only a few sound errors are treated.

In reviewing the literature, statistical comparisons between the time it takes to complete (administer and analyze) a phonological analysis and the time it takes to complete a phonetic analysis were not found. This lack of data lead to the development of this study, which was undertaken in order to determine the accuracy of the

clinician's perceptions that a phonologic process assessment is more time-consuming than a phonetic assessment. The phonologic process tests used in this study were the Assessment of Phonological Processes-Revised (APP) (Hodson, 1986) which was analyzed by the Computer Analysis of Phonological Processes (CAPP) (Hodson, 1985) and the Khan-Lewis Phonological Analysis (KLPA) (Khan & Lewis, 1986). The phonetic tests used in this study were the Goldman Fristoe Test of Articulation (GFTA) (Goldman & Fristoe, 1986) and the Photo Articulation Test (PAT) (Pendergast, Dickey, Selmar, & Soder, 1969)

The purpose of this study was to determine if the time it takes to complete a phonological test was significantly different than the time it takes to complete a phonetic test. It was hoped this study would identify an instrument that the public school speech-language pathologist could use more effectively and efficiently to analyze phonologically-impaired children.

Twelve subjects, ages 4-1 to 6-7 years with mild, moderate, or severe phonologic and/or phonetic disorders participated in this study. Five speech-language pathology students who had experienced at least two speech and hearing clinics at PSU, were selected as examiners for this study.

The mean ($\bar{X}$) and standard deviation (S.D.) of the completion time of each test used in this study were

calculated and are as follows: APP as analyzed by the APP (APP/CAPP): $\overline{x}$ = 22:56, S.D. 3:29; the KLPA with the transcription time from the GFTA Sound-in-Words Subtest: $\overline{x}$ = 43:14, S.D. = 11:56; the KLPA without transcription time from the GFTA Sounds-in-Words Subtest: $\overline{x}$ = 37:26, S.D. = 11:01; the GFTA: x = 26:13, S.D. = 4:05; the PAT: $\overline{x}$ = 11:27, S.D. = 2:04. Two-tailed $\underline{t}$-tests for dependent means were used to compare two phonological tests (APP/CAPP and KLPA) with two phonetic tests (GFTA and PAT). The study revealed that each comparison was significantly different beyond the .05 level of confidence. The APP/CAPP (phonologic process test) takes significantly less time to complete than the GFTA (phonetic test). The PAT (phonetic test) takes significantly less time to complete than the APP/CAPP and the KLPA. The GFTA takes significantly less time to complete than the KLPA. Additionally, the phonological tests were compared with each other and the results revealed that the APP takes significantly less time to complete than the KLPA.

The data also revealed that the more severe the child's speech sound disorder, the more time is needed to complete a phonetic or phonologic test. Although the number of subjects that participated in this study is limited, information gathered might be helpful in demonstrating that there are phonologic tests, such as the

APP/CAPP, which are less time-consuming than some frequently used phonetic tests, such as the GFTA.

IMPLICATIONS

Research

Further research regarding the timing of phonologic process tests is warranted. A replication of this study could be conducted using more experienced clinicians instead of students and/or with a larger sample size, which would result in a more representative sample . This larger sample size could also be completed with children who are soley moderately and severely impaired. In addition, the same phonologic process tests, i.e., APP/CAPP or KLPA or different phonologic process tests, i.e., NPA or PPACL could be compared to the same phonetic tests, i.e., PAT or GFTA or different phonetic tests, i.e., The Templin-Darley Tests of Articulation (Templin & Darley, 1969) or The Arizona Articulation Proficiency Scale (Fudala, 1970).

Research comparing the timing of phonological process one-word elicited tests (APP/CAPP, KLPA or Compton-Hutton Phonological Assessment, Compton & Hutton, 1978) to phonological processes obtained from a language sample (NPA or Phonological Assessment of Child Speech, Grunwell, 1985) could be implemented to determine which has the greatest efficiency.

Research which compares the times it takes to complete various computer-aided phonologic analysis versus the amount of time it takes to complete manual analysis of the same test might also be helpful. In addition, the time comparisons of various computer-aided phonologic analyses could be compared to each other, i.e., the CAPP versus the PEPPER. Further research in the development of computer programs for already exsisting phonologic assessment tools such as the KLPA could also be developed to help save the clinician time. Present computer programs such as the CAPP could be further developed in order to provide a more effective and thorough analysis, i.e., the CAPP program, which analyzes 10 processes, could be developed so it would calculate the 30 processes which are analyzed when completing a manual analysis of the APP.

A time comparison study of a phonological process remediation approach versus a phonetic remediation approach with phonologically-impaired children would also be very useful. If it could be empirically proven that a phonologic treatment approach saved significantly more time than a phonetic treatment approach then clinicians might be more apt to assess as well as treat phonologically-impaired children by using a more efficient as well as effective phonologic approach.

Clinical

Results of the current study provide clinicians with additional information regarding which test is the most efficient to administer and analyze. According to the results of this study the APP/CAPP is the most efficient phonological processes test and the PAT is the most efficient phonetic test. Outcomes of this study will also help the clinician to know approximately how much time to allow when scheduling phonetic and/or phonologic assessments. It would also provide information on approximately how much additional time to allow if the child has a more severe impairment versus a mild impairment.

Data from this study could provide additional and/or more statistically accurate completion times for the authors to place in their manuals, since most of the times in the manuals appear to be estimations, which may be inaccurate.

In order for the clinician to be the most effective in treating and assessing the speech-impaired child, knowledge in phonetic assessments as well as phonologic assessments are needed. This study gives the clinician some general knowledge on phonological processes which will help the clinican to be more effective.

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APPENDIX A

PHONOLOGICAL PROCESSES DEFINITIONS USED IN THE ASSESSMENT OF PHONOLGICAL PROCESSES-REVISED

Source: Hodson, 1986

DEFINITIONS OF THE PHONOLOGICAL PROCESSES USED IN
THE ASSESSMENT OF PHONOLGICAL PROCESSES   (Hodson, 1986)

<u>Consonant Sequence Reduction</u>: occurs when a consonant in a
sequence is deleted (e.g., /trIŋ/ for "string").

<u>Glides</u>: occurs when /w/ or /j/ are substituted with a
non-glide phoneme (e.g., /paS/ for "wash") or omitted
(e.g., /aS/ for " wash").

<u>Liquid (l)</u>: occurs when /l/ is omitted (e.g., /if/ for
"leaf") or substituted by a non-liquid phoneme (e.g., /wif/
for "leaf").

<u>Liquid (r)</u>: occurs when /r, ə̣ / is substituted by a
nonliquid phoneme (e.g., /waIt/ for "right") or omitted
(e.g., /aIt/ for "right").

<u>Nasals</u>: occurs when nasal phonemes are omitted (e.g.,
/oUz/ for "nose") or substituted with a non-nasal phomeme
(e.g., /poUz/ for "nose".

<u>Postvocalic Singleton Consonant Omission</u>: occurs when a
consonant that ends a syllable is deleted (e.g., /wa/ for
"watch").

<u>Prevocalic Singleton Consonant Omission</u>: occurs when a
consonant that initiates a syllable is deleted (e.g., /e i/
for "baby").

<u>Stridents</u>: occur when stridency is deleted from a word; it
can be either from a deleted strident (e.g., /u/ for
"shoe") or due to a substitution of a nonstrident phoneme
in place of the correct strident phoneme (e.g., /tu/ for
"shoe").

<u>Syllable Reduction</u>: occurs when a syllable is deleted in a
multi-syllable word (e.g., /pe/ for "paper").

<u>Velars</u>: occur when either the velars /k/ or /g/ are
omitted (e.g., /om/ for "comb") or substituted by a
nonvelar phoneme (e.g., /tom/ for "comb").

APPENDIX B

PHONOLOGICAL PROCESS DEFINITIONS IN THE
KHAN-LEWIS PHONOLOGICAL ANALYSIS

Source: Khan & Lewis, 1986

THE KHAN-LEWIS PHONOLOGICAL ANALYSIS
PHONOLOGICAL PROCESS DEFINITIONS (Khan & Lewis, 1986)

<u>DEVELOPMENTAL PHONOLOGICAL PROCESSES</u>: normal developing processes.

<u>Cluster Simplification</u>: occurs when one or more members of a consonant sequence are deleted or when a schwa is inserted between them (e.g., /wIno/ for "window").

<u>Consonant Harmony</u>: occurs when one consonant is affected by another consonant within the word and so both are produced at similar places of articulation (e.g., /pʌp/ for "cup").

<u>Deaffrication</u>: occurs when the stop feature of an affricate is deleted with the retention of the fricative feature (e.g., /mæʃiz/ for "matches").

<u>Deletion of Final Consonants</u>: occurs when the final consonant of the word is deleted (e.g., /ple/ for "plane").

<u>Final Devoicing</u>: occurs when the speaker produces a voiceless consonant for a voiced consonant in the final consonant (e.g., /bɛt/ for "bed").

<u>Initial Voicing</u>: occurs when a voiced consonant is used in place of the correct voiceless consonant (e.g., /gʌp/ for "cup").

<u>Liquid Simplification</u>: either gliding of liquds (e.g., /bju/ for "blue") or vocalization of liquids (e.g., /Sʌvo/ for "shovel").

<u>Palatal Fronting</u>: occurs when a speaker replaces a palatal consonant for a consonant in a more anterior portion of the mouth (e.g., /su/ for "shoe").

<u>Stopping of Fricatives and Affricates</u>: occurs when fricatives are replaced by affricates or stops, and when affricates are replaced by stops (e.g., /dIs/ for "this").

<u>Stridency Deletion</u>: occurs when the production of a strident consonant lacks stidency due to either deletion or replacement (e.g., /tu/ for "shoe").

<u>Syllable Reduction</u>: occurs when the speaker's production contains fewer syllables than the target word (e.g., /win/ for "window").

<u>Velar Fronting</u>: occurs when the speaker replaces a velar
with a consonant located more anteriorly in the mouth than
a velar, often occurs by replacing a velar with an alveolar
(e.g., /tar/ for "car").

<u>NONDEVELOPMENTAL PHONOLOGICAL PROCESSES</u>: those not
characteristic of normal phonological development, but some
normally developing children may apply them infrequently.

<u>Backing to Velars</u>: occurs when any consonant is replaced
by a velar (e.g., /gɛk/ for "bed").

<u>Deletion of Initial Consonants</u>: occurs when the initial
consonant is deleted (e.g., /ʌn/ for "gun").

<u>Glottal Replacement</u>: occurs when a consonant is replaced
by a glottal stop (e.g., /mæʔIz/ for "matches").

APPENDIX C

PARENTAL CONSENT FORM

Dear Parent/Guardian,

My name is Beverly Alexander. I am a graduate student at Portland State University in the field of Speech-Language Pathology. I am conducting a research project under the supervision of Mary Gordon, Associate Professor, concerning tests used to assess children who have speech sound disorders. I am attempting to determine the length of time it takes to administer and score various speech sound tests. The results of this study should help the clinician to utilize a more efficient means to assess children with speech sound disorders.

I am searching for children between the ages of 4 and 6 years to help with this research. If you and your child participate in this study, I would need to see him/her on one occasion to do some testing. The testing would involve a brief hearing test and administration of three speech sound tests. This would take approximately one hour in the Portland State University Speech and Hearing Sciences Department. The testing would be completed by a Speech-Language Pathology graduate student.

Your child's name will not be used in reporting results. You may obtain your child's tests results from me. You will, of course, be free to withdraw your child from the study at any time without jeopardizing your relationship with Portland State University. There will be no charge for the evaluations.

If there are any questions or problems regarding any aspect of this study, I may be reached at school (464-3533). Additionally, Mary Gordon, faculty thesis director, may be reached at the same number.

If you have any problems that are the result of your participation in this study, please contact the secretary of the Human Subjects Research and Review Committee, Office of Grants and Contracts, 303 Cramer Hall, Portland State University, 464-3417.

Please complete the attached approval sheet and return it in the self-addressed stamped envelope provided. If you indicate you are willing to participate, I will be contacting you within a few days by telephone to varify meeting times.

Thank you for your help.

Beverly Alexander
Speech-Language Pathology
Master's student, PSU

_____ I am interested in participating in your study.

_____ I am not interested in participating in your study.

SIGNATURE_____DATE:_____

CHILD'S NAME:_____BIRTHDATE:_____

ADDRESS:_____

_____

PHONE
NUMBER: _____

APPENDIX D

EXAMINER'S QUESTIONNAIRE

EXAMINER'S QUESTIONNAIRE

The following questionnaire is designed to determine the eligibility of speech-language pathology graduate students for a study which will compare the administration and analysis times of phonetic and phonologic speech sound disorder tests. The results of this study should help the clinician to utilize a quicker and more efficient means of assessing children with speech sound disorders. Your participation in completing this questionnaire and possibly participating in this study is greatly appreciated. This study will require approximately 4 to 5 hours of your time. Two to three hours will be spent administering tests at PSU and 2 to 3 hours will be spent analyzing the tests, which can be completed at your home. The study will be implemented at your convenience.

Thank You. Beverly Alexander

			YES	NO	No. of Times
1.	a.	Have you ever administered the <u>Photo Articulation Test</u> (PAT)?			
	b.	Have you ever scored the PAT?			
	c.	If you answered "no" to (a) or (b), have you received formal instruction in the administration and analysis of the PAT during a PSU course within the last two years?			
2.	a.	Have you ever administered the <u>Assessment of Phonological Processes-Revised</u> (APP)?			
	b.	If you answered "no" to (a), have you received formal instruction in the adminis- tration of the APP during a PSU course within the last two years?			

3. a. Have you ever analyzed the
        APP using the <u>Computer
        Analysis of Phonological
        Processes</u> (CAPP)?

    b. If you answered "no" to (a),
        have you received formal
        instruction in the analysis
        of the APP by using the CAPP
        during a PSU course within
        the last two years?

---

4. a. Have you ever administered
        the <u>Goldman-Fristoe Test of
        Articulation</u> (GFTA)?

    b. Have you ever scored the
        GFTA?

    c. If you answered "no" to (a)
        or (b), have you received
        formal instruction in the
        administration and analysis
        of the GFTA during a PSU
        course within the last
        two years?

---

5. a. Have you ever administered
        the <u>Khan-Lewis Phonological
        Analysis</u> (KLPA) (it is the
        same as the <u>Sounds-in Words
        Subtest</u> of the GFTA)?

    b. Have you ever scored the
        KLPA?

    c. If you answered "no" to (a)
        and (b), have you received
        formal instruction in the
        administration and analysis
        of the GFTA during a PSU
        course within the last
        two years?

---

6. Are you interested in receiving clock hours during
participation in this study?

7. If you are interested in participating in this study,
please write your name and the telephone number where you
can be reached during the summer, and then place this
questionnaire in my box (Beverly Alexander) in the graduate
room.   Thanks again.

APPENDIX E

OUTLINE OF INFORMATION COVERED IN TRAINING PERIOD

OUTLINE OF INFORMATION COVERED IN TRAINING PERIOD

I.   Administration and analysis procedures as listed in the test manuals

    A.   Photo Articulation Test (PAT)
    B.   Assessment of Phonological Processes (APP)
    C.   Khan-Lewis Phonological Analysis (KLPA)
    D.   Goldman-Fristoe Test of Articulation (GFTA)
    E.   Computer Analysis of Phonological Processes (CAPP)

II.   Timing Procedures for the administration and analysis of each test as described in Appendix F

    A.   PAT
    B.   APP
    C.   KLPA
    D.   GFTA
    E.   CAPP

III. Materials given to the examiners

    A.   Test forms for each test (PAT, APP, KLPA, GFTA, and, CAPP).
    B.   Examiners timing procedures and instructions
    C.   Chart to record timed-results (Appendix I)
    D.   Outline of material to be covered in the training session.

APPENDIX F

EXAMINER'S TIMING PROCEDURES AND INSTRUCTIONS

EXAMINER'S TIMING PROCEDURES AND INSTRUCTIONS

Administration

1. Time the administration of each test separately, also time those subtests separately as listed on the "Chart to Record Timed Results" (Appendix I).

2. Begin timing of each test after all materials needed for testing are in place and child is sitting in his/her seat and prior to instructing the child.

3. If child needs a break in the middle of testing, stop the stop watch until he/she is seated again. Begin the stop watch when the child is back in his seat and you are ready to begin testing again.

4. The administration of each test will be the same as outlined in their manuals except:
    a. When giving the GFTA write out the entire response phonetically on the Sounds-in-Words subtest in order to be prepared to analyze the KLPA using this transcription.

5. In order to calculate the administration time of the KLPA, when giving the GFTA, calculate the time it takes to administer the Sounds-in-Words subtest separately from the time it takes to administer the rest of the GFTA. When the Sounds-in-Words subtest has been completed stop the stop watch and mark the time. Then restart the stop watch when you are ready to begin the next subtest.

6. When the last question, for each test has been answered by the subject, turn the stop watch off and record the time on the time recording sheet.

Analysis

1. Time the analysis of all tests separately, also time specific areas of each test separately which are listed on the "Chart to Record Timed Results" (Appendix I).

2. When all materials needed to analyze the test are in front of you, start the stop watch.

3. If for any reason you are distracted or need a break in the middle of analyzing the test, stop the stop watch and restart the stop watch when you are seated and ready to begin analyzing the test again.

4.   The analysis of each test will be completed as outlined in their manuals, except:
     a.   The APP will be analyzed using the CAPP.

5.   When you are satisfied that all of the responses have been analyzed, stop the stop watch and record the results on the recording sheet for each individual test.

6.   When using the CAPP begin timing after the disc is in your hand, and before you turn the computer on.   After the results are printed, and you have torn them off of the printer, turn the timer off and mark your time.

7.   The analysis of all four tests should be completed within six weeks from the administration date.

8.   Thank you.

APPENDIX G

THE RECORDING FORM FOR THE
ASSESSMENT OF PHONOLOGICAL PROCESSES-REVISED

Source: Hodson, 1986

THE ASSESSMENT OF PHONOLOGICAL PROCESSES—Revised
Barbara Williams Hodson

Name _____ Birthdate _____ Date _____ Examiner _____

1. basket 'bæskɪt	**11. feather** 'fɛðɚ	**21. jump rope** 'ʤʌmp,roup	**31. Santa Claus** 'sæntə,klɔz	**41. string** strɪŋ
2. boats bouts	**12. fish** fɪʃ	**22. leaf** lif	**32. screwdriver** 'skru,draɪvɚ	**42. sweater** 'swɛtɚ
3. candle 'kænd!̣	**13. flower** 'flauwɚ	**23. mask** mæsk	**33. shoe** ʃu	**43. television** 'tɛlə,vɪʒən
4. chair ʧɛɚ	**14. fork** fɔɚk	**24. mouth** mauθ	**34. slide** slaɪd	**44. thumb** θʌm
5. cowboy hat 'kaubɔɪ,hæt	**15. glasses** 'glæsɪz	**25. music box** 'mjuzɪk,baks	**35. smoke** smouk	**45. toothbrush** 'tuθ,brʌʃ
6. crayons **7. three** **8. black** **9. green** **10. yellow** 'kreɪənz θri blæk grin 'jɛlou	**16. glove** glʌv	**26. nose** nouz	**36. snake** sneɪk	**46. truck** trʌk
	17. gum gʌm	**27. page** peɪʤ	**37. soap** soup	**47. vase** veɪs
	18. hanger 'hæŋɚ	**28. (air)plane** pleɪn	**38. spoon** spun	**48. watch** waʧ
	19. horse hɔɚs	**29. queen** kwin	**39. square** skwɛɚ	**49. yoyo** 'jou jou
	20. ice cubes 'aɪs,kjubz	**30. rock** rak	**40. star** staɚ	**50. zipper** 'zɪpɚ

APPENDIX H

COMPUTER PRINT OUT OF THE COMPUTER ANALYSIS OF PHONOLOGICAL PROCESSES

Source: Hodson, 1985

Name of Client:
Date of Birth: 1-3-84
Date of Phonological: 10-12-87
Age in Years: 3
Examiner's Name: Beverly Alexander
Diagnostic Information:

Phonological Analysis Summary

Pattern Deviations	Percentage of Occurrence
Syllable Reduction	42
Prevocalic Singletons	16
Postvocalic Singletons	3
Consonant Sequences	78
Stridents	65
Velars	100
Liquid (l)	91
Liquid (r)	100
Nasals	11
Glides	80

Average of Phonological Processes: 59
Phonological Deviancy Score: 22
Severity Interval: Severe

GOAL: To increase intelligibility by facilitating
emergence of the following phonological patterns:

        Syllables
        Consonant Sequences
        Stridents
        Velars
        Liquid (l)
        Liquid (r)
        Glides

        COMPUTER ANALYSIS of PHONOLOGICAL PROCESSES
                Barbara Williams Hodson
                Copyright 1985; Phonocomp

APPENDIX I

CHART TO RECORD TIMED RESULTS

CHART TO RECORD TIMED RESULTS

Test	Administration Time			Analysis Time		
	Subj. 1	Subj. 2	Subj. 3	Subj. 1	Subj. 2	Subj. 3
APP						
CAPP						
GFTA S.I.W.				Transcription to matrix	Transcription to matrix	Transcription to matrix
GFTA S.I.S.				Transcription to matrix	Transcription to matrix	Transcription to matrix
GFTA Stimula- bility.						
GFTA Scoring						
GFTA Total						
KLPA						
KLPA G.S.W						
KLPA Scoring						
KLPA Total						
PAT						

Assessment of Phonological Processes (APP)
Computer Assessment of Phonological Processes (CAPP)
Goldman-Fristoe Test of Articulation (GFTA)
    Sounds-in-Words Subtest (S.I.W.)
    Sounds-in-Sentences Subtest (S.I.S.)
Khan-Lewis Phonological Analysis (KLPA)
    Goal Selection Worksheet (G.S.W.)
Photo Articulation Test (PAT)

APPENDIX J

TOTAL OF THE ADMINISTRATION AND ANALYSIS TIMES FOR THE APP/CAPP, KLPA, GFTA, AND PAT

TOTAL OF ADMINISTRATION AND ANALYSIS TIMES

APP AND CAPP

```
     Administration        Analysis          Total        Severity
Examiner 1
1.   11:50 (710)    +   9:29 (569)   =  21:19 (1279)   (mild)
2.   15:34 (934)    +  10:41 (641)   =  26:15 (1575)   (severe)
3.   15:24 (924)    +  10:38 (638)   =  26:02 (1562)   (severe)
4.   13:15 (795)    +  10:59 (659)   =  24:14 (1454)   (moderate)

Examiner 2
1.   14:47 (887)    +  12:48 (768)   =  27:35 (1655)   (severe)
2.   12:03 (723)    +   8:04 (484)   =  20:07 (1207)   (mild)

Examiner 3
1. 12:09 (729)      +   6:43 (403)   =  18:52 (1132)   (mild)
2. 12:44 (764)      +  13:38 (818)   =  26:22 (1582)   (moderate)

Examiner 4
1.   11:12 (672)    +   7:16 (436)   =  18:28 (1108)   (moderate)
2.   12:40 (760)    +   9:45 (585)   =  22:25 (1345)   (mild)

Examiner 5
1.   16:03 (963)    +  10:12 (612)   =  26:15 (1575) (moderate)
2.    8:49 (529     +   8:31 (511)   =  17:20 (1040) (moderate)
```

KLPA WITHOUT TRANSCRIPTION

```
   Administration      Analysis          Total
Examiner 1
1.   6:58 (418)   +   16:21 (981)  = 23:19 (1399)
2.   6:41 (401)   +   34:47 (2087) = 41:28 (2488)
3.   6:35 (395)   +   35:23 (2123) = 41:58 (2518)
4.   6:59 (419)   +   34:17 (2057) = 41:16 (2476)

Examiner 2
1.   9:45 (585)   +   43:16 (2596) =  53:01 (3181)
2.   5:00 (300)   +   17:11 (1031) =  22:11 (1331)

Examiner 3
1.   8:27 (507)   +   16:13 (973)  =  24:40 (1480)
2.   7:48 (468)   +   15:10 (910)  =  22:58 (1378)

Examiner 4
1.   6:52 (412)   +   45:31 (2731) = 52:23 (3143)
2.   5:59 (359)   +   29:05 (1745) = 35:04 (2104)

Examiner 5
1.   7:07 (427)   +   37:14 (2234) = 44:21 (2661)
2. 11:30 (690)    +   34:58 (2098) = 46:28 (2788)
```

KLPA WITH TRANSCRIPTION

```
   Administration      analysis          total
Examiner 1
1.   6:58 (418)   +   19:46 (1186) =  26:44 (1604)
2.   6:41 (401)   +   40:10 (2410) =  46:51 (2811)
3.   6:35 (395)   +   41:47 (2507) =  48:22 (2902)
4.   6:59 (419)   +   40:57 (2457) =  47:56 (2876)

Examiner 2
1.   9:45 (585)   +   48:20 (2900) =  58:05 (3485)
2.   5:00 (300)   +   20:24 (1224) =  25:24 (1524)

Examiner 3
1.   8:27 (507)   +   21:36 (1296) = 30:03 (1803)
2.   7:48 (468)   +   23:09 (1389) = 30:57 (1857)

Examiner 4
1.   6:52 (412)   +   53:49 (3229) = 60:41 (3641)
2.   5:59 (359)   +   32:21 (1941) = 38:20 (2300)

Examiner 5
1.   7:07 (427)   +   44:40 (2680) = 51:47 (3107)
2. 11:03 (690)    +   42:10 (2530) = 53:40 (3220)
```

GFTA

```
   Administration     Analysis        Total
Examiner 1
1.   17:23 (1043) + 5:50 (350) = 23:13 (1393)
2.   18:40 (1120) + 1047 (647) = 29:27 (1767)
3.   19:11 (1151) + 7:49 (469) = 27:00 (1620)
4.   17:45 (1065) + 7:23 (443) = 25:08 (1508)

Examiner 2
1.   24:07 (1487) + 7:34 (454) = 32:21 (1941)
2.   15:57 (957)  + 2:38 (158) = 18:35 (1115)

Examiner 3
1.   15:49 (949)  + 11:38 (698) = 27:27 (1647)
2.   18:04 (1084) +  5:14 (314) = 23:18 (1398)

Examiner 4
1.   20:55 (1255) +  7:57 (477) = 28:52 (1732)
2.   15:56  (956) +  4:01 (241) = 19:57 (1197)

Examiner 5
1.   22:16 (1336) +  6:25 (385) = 28:41 (1721)
2.   24:27 (1467) +  6:18 (378) = 30:45 (1845)
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PAT

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   Administration  Analysis      Total
Examiner 1
1.    7:25 (445)  +  23  =   7:48 (468)
2.   11:52 (712)  +  39  =  12:31 (751)
3.   11:51 (711)  +  44  =  12:35 (755)
4.   10:16 (616)  +  25  =  10:41 (641)

Examiner 2
1.   12:48 (768)  +  21  =  13:06 (789)
2.   10:27 (627)  +  46  =  11:13 (673)

Examiner 3
1.    8:59 (507)  +  30  =   9:29 (537)
2.   10:43 (643)  +  33  =  11:16 (676)

Examiner 4
1.   11:12 (672)  +  45  =  11:57 (717)
2.    8:31 (511)  +  25  =   8:56 (536)

Examiner 5
1.   12:18 (738)  +  23  =  12:41 (761)
2.   15:13 (913)  +  23  =  15:36 (936)
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