1974

Phonetic Context and Articulation Therapy of /r/ Blends

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PHONETIC CONTEXT AND ARTICULATION

THERAPY OF /r/ BLENDS

(TITLE)

BY

Deborah D. Cline

THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF

Master of Science

IN THE GRADUATE SCHOOL, EASTERN ILLINOIS UNIVERSITY
CHARLESTON, ILLINOIS

1974
YEAR

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ACKNOWLEDGEMENTS

Gratitude is expressed to Dr. Lynn Miner and my thesis committee for their direction and helpful advice. Thanks is also extended to the Charleston School System and Mrs. Sylvia James who provided the subjects for this study. A special thanks goes to my parents and Charles DeWitt for their constant encouragement and faith.

DEDICATION

This thesis is dedicated to my grandfather, Mr. George Magarcsik, and his belief in education.

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CHAPTER I

INTRODUCTION

Verbal communication is an important aspect of human functioning. Effective daily living in today's society depends heavily on the communicative processes. However, there are often breakdowns in these processes, and it is the speech pathologist who often plays a role in aiding the individual with defective speech patterns.

The speech pathologist's greatest case load can be found in the public schools where it is estimated that approximately 80 percent of the speech defective population has articulation errors (Powers, 1971). Van Riper (1963) indicates that approximately 80 percent of these articulation errors involve the /r/, /s/, /l/, /θ/ phonemes both as singles and in blends. If the speech pathologist is to work as effectively as possible with a large number of cases, it is important that the most facilitating techniques be used in order to insure progress.

Spriestersbach and Curtis (1951) and Sayler (1949) note that individuals generally are not consistent in their misarticulations of a phoneme. Spriestersbach and Curtis feel that these inconsistencies can be accounted for on a systematic basis, in terms of phonetic context.

Ettinger (1973) states that "four lawful, systematic variables to speech sound production are: 1) phonetic context; 2) frequency of occurrence; 3) syllabic position; and 4) syllabic stress" (pp. 3). If these variables are indeed characteristic of speech sound production, they should be taken into consideration by the speech pathologist when she is planning articulation therapy.

The traditional approach to articulation therapy suggests that the misarticulated phoneme be introduced in isolation, in nonsense syllables, in words, in phrases and sentences and in conversation, successively. It does not take into account any of the above mentioned variables. Furthermore, the initial, medial and final classifications which this technique supports are dismissed by Keenan (1961) in favor of a more precise classification based on "the consonant's relationship to its syllable, and the syllable's position within the word or phrase..." (pp. 174).

Phonetic context and frequency of occurrence are two variables which perhaps should be considered more often in the planning of articulation therapy. Leonard and Ritterman (1971) found that initial and final /s/ blends of high frequency of occurrence "appear related to the frequency with which these clusters occur, making the more common concatenations more available for the child to discriminate and practice in his language usage." (pp. 484). Thus, the identification of a more frequently occurring phonetic context of a misarticulated

sound could possibly reduce the amount of "trial and error" time spent at the beginning of therapy. In addition, the child might have increased opportunity for practice and success. In which case, the improved articulation would be more evident.

Schneider (1973) suggests that syllable stress (accented or unaccented) interacts with syllable position to influence rank ordering of the /r/ and /s/ phonemes (pp. 59). She also designates that syllabic stress can be a facilitating factor in the correct production of an error sound in some contexts. Griffith and Miner (1973) state that "stress seems to be the product of an over-all energy increase in the entire phonatory mechanism...this would mean that the parameters of phonetic context analysis should be extended to include syllabic stress" (pp. 10).

Traditionally, speech pathologists have preferred to begin articulation therapy with phonemes in the single contexts as opposed to the blend contexts. However, Spriestersbach and Curtis (1951) noted that articulation therapy using blends may be more facilitating than using singles. Schneider (1973) found that a statistically significant difference exists between single and blend performances for the /r/ phoneme. The results indicated that the single-blend therapy methods be dismissed in favor of the blend-single therapy methods.

The Thorndike-Lorge word list of the 1,000 most frequently

occurring English words for first and second graders was used as the basis for a study done by Ettinger (1973). She examined the three most frequently occurring /r/ phonetic contexts, namely: /ɛr/, /rɪ/, /rɛ/. The results of the investigation led her to conclude that there were no significant differences in the rate of acquistion among the three contexts. She also concluded that the rank ordering which resulted was not significant. Her study indicates the need for further investigation in the area of phonetic context analysis.

It is evident that phonetic context analysis can yield much useful information about how the various phonemes are articulated. In order to enhance our present methods of articulation therapy these anaylses should be made when planning articulation therapy. However, there is a need to further investigate the details of phonetic context analyses as a therapy technique. This investigation examined the /r/ phoneme as contained in high, middle and low frequency of occurrence initial stressed blend contexts.

Statement of Purpose

The purpose of this study was to analyze the responses of four children with misarticulations of the /r/ blends. In particular, the /r/ blends as contained in high, middle and low frequency of occurrence initial stressed blend contexts were studied. Those contexts studied were /pr/, /br/, /θr/. The training words for these contexts

were "pretty", "brown" and "three", respectively. Specifically, the following questions were posed:

1. Is there a statistically significant difference in the rate of acquistion of the /r/ phoneme as contained in high, middle and low frequency of occurrence initial stressed blend contexts?

2. What is the resulting rank order of the high, middle and low frequency of occurrence initial stressed blend contexts of /r/?

CHAPTER II

REVIEW OF THE LITERATURE

Deviant Speech in the Schools

The greatest number of deviant speech disorders can be found in the public schools. By way of a nationwide sampling, Bingham, Van Hattum, Faulk and Taussig (1961) were able to establish that 81 percent of the speech defectives in the schools exhibited functional articulation disorders. Powers (1971) supported this finding by indicating that approximately 80 percent of the speech defective population in the schools have articulation disorders.

Approximately 80 percent of these articulation errors involve the /r/, /s/, /l/, /θ/ phonemes both as singles and in blends (Van Riper, 1963). To further uphold the use of the /r/ phoneme in this study, Schneider (1973) cites a study done by the Southwest Regional Laboratory for Educational Research and Development which reports that 80 percent of the case loads in 949 speech clinics in the United States consisted of articulation disorders of the /r/, /s/, /l/, /θ/ phonemes.

Acquistion of the /r/ Phoneme

Poole (1934) stated that the /r/ phoneme may not be acquired developmentally until 7.5 years of age. Some years later, Templin (1957)

showed that the /r/ phoneme is acquired proficiently at age 4.0. Both Poole and Templin used a criterion of 75 percent correct productions for their subjects. A 90 percent correct production criterion basis was used by Hall-Healy (1962, 1963). The results of their studies show that girls can proficiently produce the /r/ phoneme at 6.0 years but that boys were not skilled in the usage of the /r/ phoneme until 7.0 years of age.

Zipf's Law

Zipf's Law of Abbreviation states that word length is related to the frequency of that word in the language. In other words, when given the opportunity to do so, people will use shorter words in lieu of longer words. This law suggests that if the frequency of words can be rank ordered, phonetic contexts can be rank ordered also.

Phonetic Context

Phonetic Context has been defined by Griffith and Miner (1973) as "the totality of phonetic conditions that affect the production of a given speech sound" (pp. 7). In order to assess the relationship of Zipf's Law to phonetic context, Griffith and Miner (1973) identified the phonetic contexts of the various English phonemes for the first 10,000 most frequently occurring words in the English language. As their instrument, they used the Thorndike-Lorge word lists. Their results indicated that phonetic contexts can be rank ordered for frequency of

occurrence. This implies that given phonetic contexts can influence articulation ability.

Curtis and Hardy (1959) indicate that children with functional articulation disorders are typically inconsistent in their misarticulations. This finding has been supported by Spriestersbach and Curtis (1951) as well as others. Curtis, Hardy and Spriestersbach note that these inconsistencies are systematic ones that occur on a lawful basis. Ettinger (1973) states that phonetic context, frequency of occurrence, syllabic position and syllabic stress are systematic variables to speech sound productions (pp. 3). These authors suggest that a need exists for a detailed anaylsis of defective speech sounds as they usually occur for each individual. An effective phonetic context anaylsis would yield a good basis for the planning of articulation therapy. Spriestersbach and Curtis (1951) uphold this by indicating that an articulation therapy program designed "in terms of the sound-in-context" may show more rapid results in terms of correction of the misarticulations because the subjects are clearly aware of the phonetic elements for which they are striving.

Blends versus Singles

Sayler (1949), Schneider (1973) and Spriestersbach and Curtis (1951) have suggested that the articulation of blends may be more facilitating than singles in therapy. In particular, Schneider (1973) found that a

greater percentage of single contexts were misarticulated as opposed to blend contexts by children with misarticulations of the /r/ and /s/ phonemes. She recommended that the traditional single-blend methods in articulation therapy be dismissed in favor of blend-single methods (pp. 61).

Syllabic Position

The variable of syllabic position can be defined as placement and/or function of the phoneme within the syllable. Keenan (1961) dismisses the traditional initial, medial and final classifications. He suggests that the syllable's position within the word or phrase would offer a more precise classification. Keenan and McDonald (1964) both view syllabic positions as having either arresting or releasing features.

Syllabic Stress

Syllabic stress can be defined as vocal emphasis on syllables. Griffith and Miner (1973) state that "stress seems to be the product of an over-all energy increase in the entire phonatory mechanism...this would mean that the parameter of phonetic context analysis should be extended to include syllabic stress" (pp. 10). Schneider (1973) indicates that the interaction of syllabic position and syllabic stress is an influence in the rank ordering of /r/ and /s/ phonemes. Since syllabic stress is a variable in speech sound production it is necessary that it be combined with the variables of frequency of occurrence, phonetic context and

syllabic position in order to enhance articulation learning.

Transfer of Learning

Although operant conditioning has not been used extensively in the field of speech correction, it's effectiveness in modifying behavior has been demonstrated over the years (Weston and Irwin, 1971). It has been suggested by McGeoch and Irion (1952) that transfer of training occurs "whenever a previously learned skill has an influence upon the acquistion, performance or relearning of a second skill." They state that the effects of transfer of training are either positive, negative, or zero. Training on one task that enhances learning on a second task is positive transfer of training. If the training on the first task inhibits the learning of a second task, this is negative transfer of training. Zero transfer of training implies that no observable influences have occurred. Stimulus similarity, amount of training, reinforcement variability and punishment are four major factors which have been found to influence the positive transfer of training (Mowrer, 1971).

Summary

The following inferences are made from this review of the literature:

1. Eighty percent of the articulation disorders found in the public schools consist of /r/, /s/, /l/ or /θ/ misarticulations.

2. The /r/ phoneme is acquired at approximately 7.5 years of age.

3. Zipf's law suggests that frequency of occurrence influences the rank ordering of phonetic contexts.

4. Articulation ability can be influenced by phonetic context.

5. Blend contexts may be more facilitating than single contexts.

6. Syllabic stress (accented and unaccented) is a variable in speech sound production.

CHAPTER III

PROCEDURE

Selection of Subjects

Four subjects were included in this study. The subjects were selected on the basis of age, hearing, intelligence, articulation and previous articulation therapy.

1. Poole (1934) states that the /r/ phoneme may not be acquired developmentally until 7.5 years of age; therefore, the subjects included in the study were not to be less than 7.5 years of age. Sayler (1949) found that the mean number of articulation errors decreases slightly beyond grade seven; therefore, the subjects were not to exceed 12 years of age. The ages of the selected subjects are shown below:

TABLE 1

SUBJECT INFORMATION

Subject	Sex	Age
1	Female	8.0
2	Male	10.5
3	Male	7.11
4	Female	7.6

2. The pure tone hearing thresholds for all subjects were not greater than 10dB (ISO, 64) bilaterally for any of the following frequencies; 500; 1,000; 2,000; and 4,000 Hz. The hearing testing was done in the same areas of the school buildings so that testing conditions were held constant.

3. All children in special educational classes and programs were excluded from this study.

4. Children who exhibited the following characteristics were excluded from this study: cerebral palsy, cleft palate, severe delay in language development, stuttering and voice disorders.

5. All subjects selected for the study exhibited a misarticulation of the /r/ phoneme in each of the selected phonetic contexts of /r/; i.e., /pr/, /br/, /θr/. A screening test consisting of twenty-two items was administered to each candidate who had been identified by his speech clinician as having a misarticulation of the /r/ phoneme. Six of the words on this test screened the /r/ phoneme in high, middle and low frequency of occurrence stressed blend contexts; namely, /pr/, /br/, /θr/. There were two words for each of these contexts. The remaining sixteen words were foil items which were not included in this study. Those children who exhibited an /r/ misarticulation in the form of a substitution or distortion in two out of two of each of the contexts qualified for participation in this study.

6. Previously, each subject had received at least six months of articulation therapy for an /r/ substitution or distortion.

Examiner Reliability

In order to establish inter-examiner reliability four judges were selected on the basis of their agreement to participate in this study. The judges were graduate students from the speech pathology and audiology department at Eastern Illinois University who had completed at least fifty hours of articulation therapy and/or testing prior to the time of this study.

During the course of this research, the examiner made a tape recording of one therapy session in the study. This session was selected at random based on a table of random numbers (Downie and Heath, 1970, pp. 328-329). The subject's responses were reinforced and scored by the examiner during the course of the session.

During the replay of the tape recording, the four judges scored each response as correct, correct in terms of approximation for shaping or incorrect. The former conditions were indicated by a positive sign (+) and the latter by a negative sign (-). The specific reinforced responses were not taken into consideration; rather, the total number of reinforced responses for each stimulus word were considered. Inter-examiner reliability percentages of agreement yielded a 98% reliability. A high degree of inter-examiner agreement is suggested.

Screening Procedure for Subject Selection

Nineteen children met the subject selection criteria and were given an articulation screening test which consisted of twenty-two items. Six of the words on this test examined the /r/ phoneme in high, middle and low frequency of occurrence stressed blend contexts; namely, /pr/, /br/, /θr/. There were two words for each of these contexts included in the test; they were as follows: "pretty" and "prove" for /pr/; "brown" and "break" for /br/; and "three and "through" for /θr/. These examination words were chosen at random from the Phonetic Context Inventory of the 1,000 most frequently occurring English words (Griffith and Miner, 1974). Those children who exhibited an /r/ misarticulation in the form of a substitution or distortion in two out of two of each of the above contexts qualified for participation in this study. For readability purposes, the Dale and Chall word lists (1948) for first and second graders was used to select at random the remaining sixteen words on the screening test. These sixteen words were foil items and were not included in this study.

Each of the screening test items was printed individually on a 3 X 5 index card and all were presented in the same order to each child. A table of random numbers (Downie and Heath, 1970, pp. 328-329) was used to establish word order presentation.

TABLE 2

SCREENING TEST ITEMS

1. get	12. make
2. day	13. by
3. that	14. some
4. were	*15. three
*5. pretty	16. like
6. five	17. home
7. add	*18. brown
8. by	19. why
*9. prove	*20. through
10. of	21. can
*11. break	22. no

* Indicates /r/ blend contexts used in this study.

Selection of Therapy Items

Griffith and Miner (1973) identified and classified 269 /r/ words in terms of phonetic contexts, syllabic position and syllabic stress. The Thorndike-Lorge word list of the 1,000 most frequently occurring English words for first and second graders was their guideline. The /r/ phoneme as contained in high, middle and low frequency of occurrence initial stressed blend contexts were chosen on the basis of the work done by Griffith and Miner. In order to establish whether frequency of occurrence was a variable in the acquistion of the /r/ phoneme, initial stressed blend contexts of high, middle and low frequency of occurrence were chosen for this investigation. The most frequently occurring initial stressed blend context used in this study

was /pr/. The initial stressed blend contexts of middle and low frequency of occurrence were /br/ and /θr/, respectively. Word lists from Griffith and Miner (1973) were used to randomly select the therapy items representative of each of these three contexts. The words that were used in the therapy sessions were as follows: "pretty", "brown" and "three".

TABLE 3

RANK ORDER OF THE FREQUENCY OF OCCURRENCE OF INITIAL ACCENTED /r/ BLENDS FROM THE FIRST AND SECOND GRADE VOCABULARY LIST
(Griffith and Miner, 1973)

Context	Frequency
*/pr/	13
/tr/	12
/gr/	11
*/br/	10
/fr/	9
/str/	7
/dr/	7
/kr/	5
*/θr/	2
/spr/	2

* Indicates contexts used in this study.

Methodology

Therapy sessions were held twice a week for four consecutive weeks. Each of the four subjects was seen on an individual basis. Each session was twenty minutes in length. Individual subjects

received approximately two hours and forty minutes each of actual therapy time.

The Language Master (M717) was used consistently throughout the sessions as the teaching instrument. The therapy words, "pretty", "brown" and "three" were recorded on blank language master cards. Each of these words was recorded three times consecutively on separate cards. Each of the stimuli were placed at equal intervals on the language master cards. Each card was 3.3 seconds in length.

To avoid bias, the three stimulus words had an assigned order for each individual subject. The order of these words was randomly established (Downie and Heath, 1970, pp. 328-329) at the onset but remained stable thereafter. Table 4 indicates the randomly selected word order for each subject.

TABLE 4

ORDER OF WORD PRESENTATION

Subject	Word Order for Each Session
1	brown, pretty, three
2	three, pretty, brown
3	three, brown, pretty
4	pretty, brown, three

Fellows (1968, pp. 41) states that "Orienting behavior serves to clarify the relevant aspects of the task, or make them more distinctive,

which will, in turn, serve to facilitate the establishment of associations between them and the appropriate executive responses." He also states that a subject "will generally perform much better on a difficult task if he is first given some training on a simpler task of the same type" (p. 26). For this reason, the first therapy session for each subject was devoted to pretraining activities. Sound production tasks were administered on an imitative basis to each subject. The tasks consisted of nonsense sounds which were placed on language master cards. These nonsense sounds were presented in the same manner as the therapy sessions outlined below.

The initial stimulus card was presented three times consecutively to the first subject; thereby, allowing the subject to hear the stimulus a total of nine times. The subject then responded to this stimulus by saying the word fifteen times successively. This procedure constituted one set. Five sets were completed before the next stimulus word was presented. The second and third stimulus words were introduced to the same subject in an identical manner. The second, third and fourth subjects, respectively, followed the same procedures as indicated above. This process represented a total of two hundred twenty-five responses for each subject during a single session. Each session was approximately twenty minutes in length. At no point was more time needed to complete the fifteen sets.

The examiner utilized a response contingent reinforcement procedure.

Responses were judged by the examiner as correct, correct in terms of approximation for shaping or incorrect. The examiner reinforced all correct and approximate responses with the presentation of a light. The correct and approximate responses were not differentiated. The light was connected to two digital counters which recorded the number of reinforcements as the light was presented. At the end of each set, the number of reinforced responses was recorded by the clinician on a standard form. This procedure was done for all sets within the sessions. At the end of each session, the total number of reinforced responses gained by each subject was tallied. These grand scores were recorded on individual charts for each subject.

Statistical Analysis

The following procedures were used to answer the questions that were posed by this investigation.

1. Is there a statistically significant difference in the acquistion of the /r/ phoneme as contained in high, middle and low frequency of occurrence initial stressed blend contexts?

Proportionate decimal values were obtained by calculating the ratio of correct responses to the total number of trial responses for each of the three contexts during the seven sessions. In order to determine if there were differences among the three /r/ blend contexts, a Kruskal-Wallis H Test of Significant Difference was calculated using the

obtained for each of the four subjects. Three scores were obtained by adding the decimal proportion values from each of the seven sessions for each of the contexts to form accumulative scores for each context.

2. What is the resulting rank order of the high, middle and low frequency of occurrence initial stressed blend contexts of /r/?

The sum of the ranks for each phonetic context was calculated on the basis of the above acquired scores. The resulting highest mean scale value represented the highest order in the ranking and the remaining scores were ranked accordingly with the lowest mean scale value receiving the lowest rank.

CHAPTER IV

RESULTS AND DISCUSSION

Four children with misarticulations of the /r/ phoneme were given articulation therapy for correction of the /r/ phoneme as contained in /pr/, /br/ and /θr/ blends. In order to establish if there were significant differences in the rate of acquistion of the /r/ phoneme as contained in these blends, statistical measures were applied. On the basis of these results, phonetic context rank order was examined.

Phonetic Context Difference

A Kruskal-Wallis H Test of Significant Difference (Downie and Heath, 1970, pp. 246-247) was calculated to determine if there were statistically significant differences in the acquistion of the /r/ phoneme as contained in the /pr/, /br/ and /θr/ blends. Proportionate decimal values were obtained by calculating the ratio of correct responses to the total number of trial responses for each of the three contexts during the seven sessions. Three scores were obtained by adding the decimal proportion values from each of the seven sessions for each of the three contexts to form accumulative scores for each context. The resulting H value of 1.84 was not statistically significant at the .05 level of confidence; consequently, the null hypothesis was accepted. This was

interpreted to mean that statistically significant differences in the rate of acquistion do not exist for the three /r/ blend contexts used in this study. Stress, phoneme position and frequency of occurrence were controlled variables in the three contexts. Thus, the results further indicate that unless a degree of varying stimulability of a given context is present, any of these three contexts could be used to initiate therapy.

The results of this investigation are consistent with the findings of Ettinger (1973). Ettinger found that the differences in the rate of acquistion were not statistically significant for the three most frequently occurring contexts of /r/ singles; namely, /ɛr/, /rI/, /rɛ/.

However, the results of the present study do not uphold the data of Leonard and Ritterman (1971) who concluded that misarticulations of /s/ clusters may be related to the frequency of occurrence of the clusters in the English language. The discrepancies between these two studies may be accounted for in the following ways: (1) Leonard and Ritterman applied parametric statistical measurements (analysis of variance) as opposed to the non-parametric measurements (Kruskal-Wallis H Test) employed in the present study. The former study presumes to examine a representative sample of the population whereas the latter does not. The parametric statistical tests tend to be more elaborate and the statistical efficiency is usually higher. This suggests that the two studies have not examined their findings in the same light and that in terms of statistical measurements they are not truly comparable. (2) The

Leonard and Ritterman study examined /s/ clusters whereas, the present study examined /r/ clusters. Thus, a phoneme difference exists which may have an influence on articulation and frequency of occurrence. (3) The high to low frequency of occurrence words covered a larger spectrum within the English language in the Leonard and Ritterman study than did the present study which took into account only the first 1,000 most frequently occurring words for first and second graders. This suggests that the Leonard and Ritterman study was concerned with truly low frequency of occurrence /s/ clusters whereas the present study may actually have involved the use of all high frequency of occurrence /r/ clusters due to the narrow spectrum employed. (4) The Leonard and Ritterman study required each of the ninety-four subjects to repeat a stimulus word once. There were twenty stimulus words. The present study required each of the four subjects to repeat a stimulus word 530 times. There were three stimulus words. Hence, the total number of responses required by each subject in the Leonard and Ritterman study was considerably less. This suggests that imitation was measured in the Leonard and Ritterman study whereas, learning was measured in the present study.

Thus, it appears that the discrepancies between the two studies do not exist on a real basis. The two studies acutally measure two different variables and therefore they are not comparable in the true sense of the word.

Phonetic Context Rank Order

Although there was no statistically significant difference in the acquisition of the /r/ phoneme as contained in the three contexts used in this study, a rank ordering of the contexts did occur.

The rank ordering of ease of acquisition for the three contexts was determined by calculating the sums of the ranks for each phonetic context. The resulting highest scale value was for the /pr/ blend. The /θr/ and /br/ blends followed respectively.

Due to the insignificance of the rate of acquisition for these three blends this ordering in not meaningful for these contexts. It must be noted, however, that rank ordering may be significant for other /r/ blend contexts.

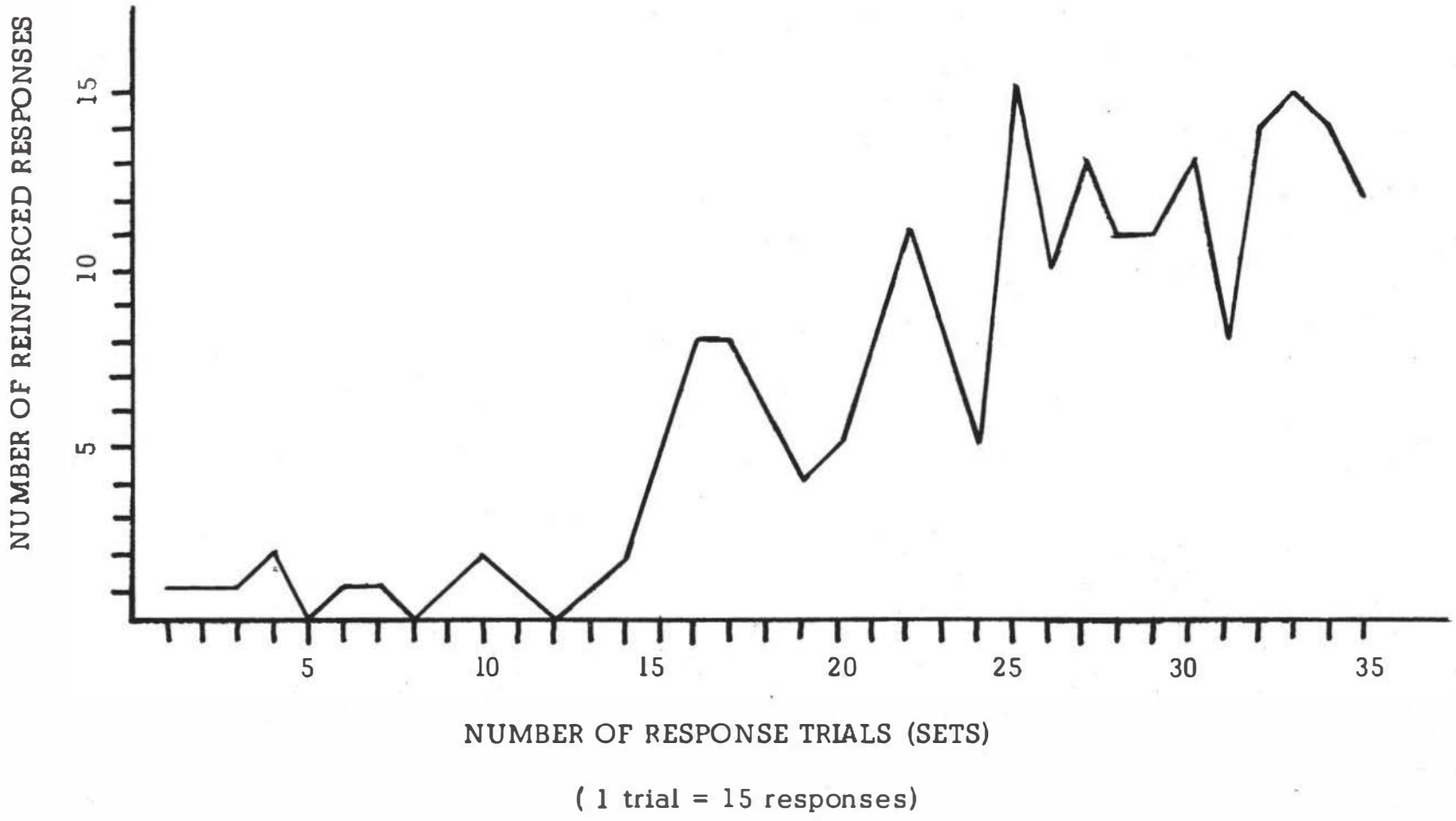
Intra-subject Learning Curve Analysis

Graphs 1 through 12 represent the learning curves for each stimulus word for each of the four subjects. They are discussed below in the order that they were presented to each subject during the course of this study.

Subject One

Graph 1: Stimulus word, "pretty". The curve has an s-shape with a relatively long tail which indicates that the task is somewhat new but that the individual is gradually learning the task. The length of the tail indicates that it is taking some time for the subject to learn the task. The entire curve has considerable variability indicating that the subject is experimenting with her productions in order to achieve responses that will be reinforced.

Graph 1. -- Learning Curve of Subject 1 for the Stimulus Word "Pretty".



Graph 2: Stimulus word, "three". This graph shows a high degree of variability. The subject is not discriminating between the response and the stimulus. It appears that her reinforced responses are gained by chance.

Graph 3: Stimulus word, "brown". A high degree of variability is evidenced in this curve. The curve appears to be rather flat until the final sets where some learning seems to be taking place as she has reached a higher level of reinforcement which is maintained to some extent.

Transfer of learning from one context to the next did not occur for this individual. A small amount of intra-subject variability is present.

Subject Two

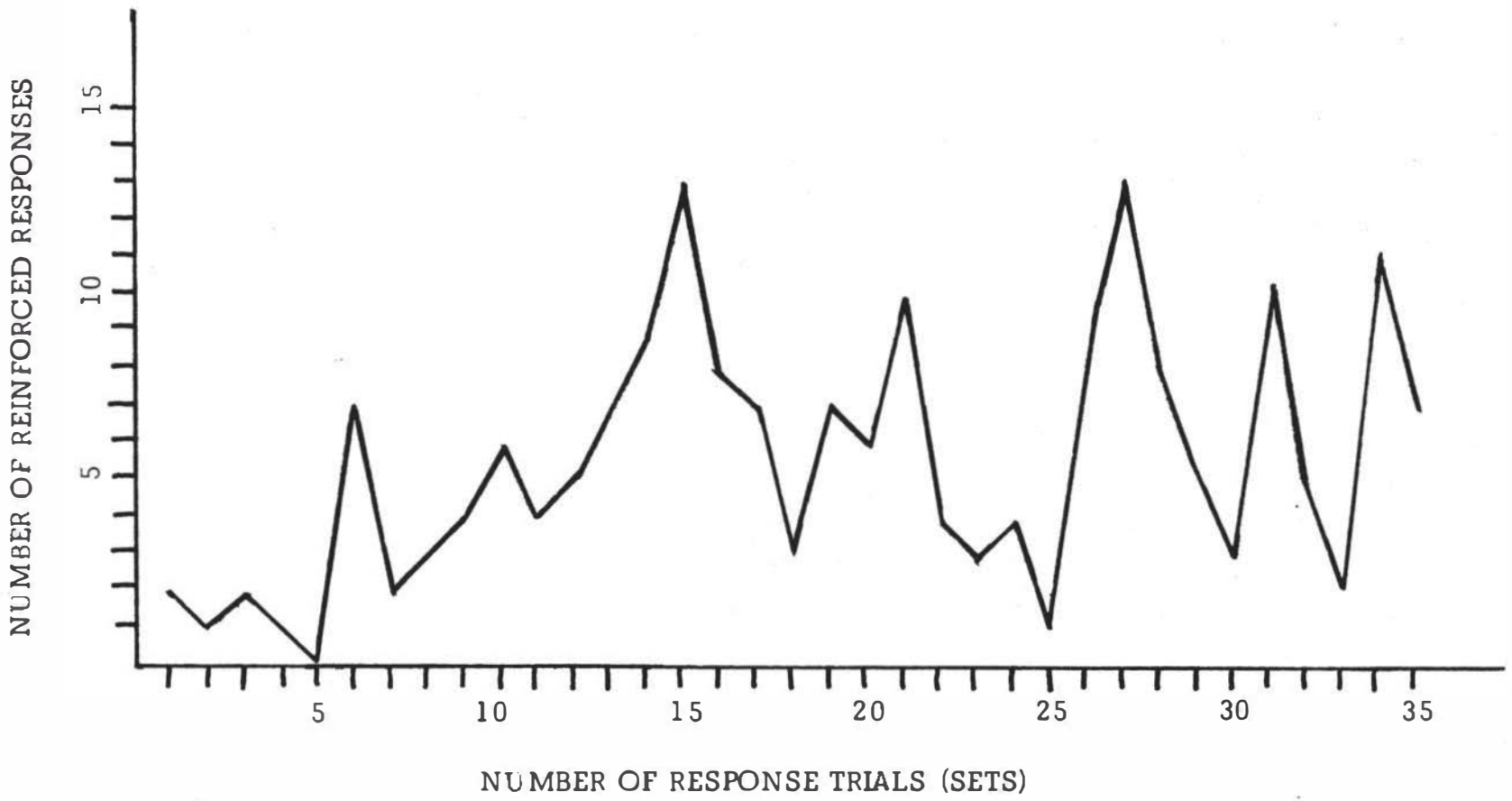
Graph 4: Stimulus word, "three". A slight s-shape curve is evident. Variability is present as the curve gradually progresses in an upward direction. The subject appears to have learned the task in the concluding stages as he was reinforced for all of his responses in the final four sets.

Graph 5: Stimulus word, "pretty". The relatively high level of reinforcement seen in the initial sets indicates that transfer of learning has occurred from the first stimulus word, "three". A high level of reinforcement is seen throughout the entire curve. After a relatively small amount of experimentation, the individual learned the task. He maintained a 100 percent reinforcement level for the final sixteen sets.

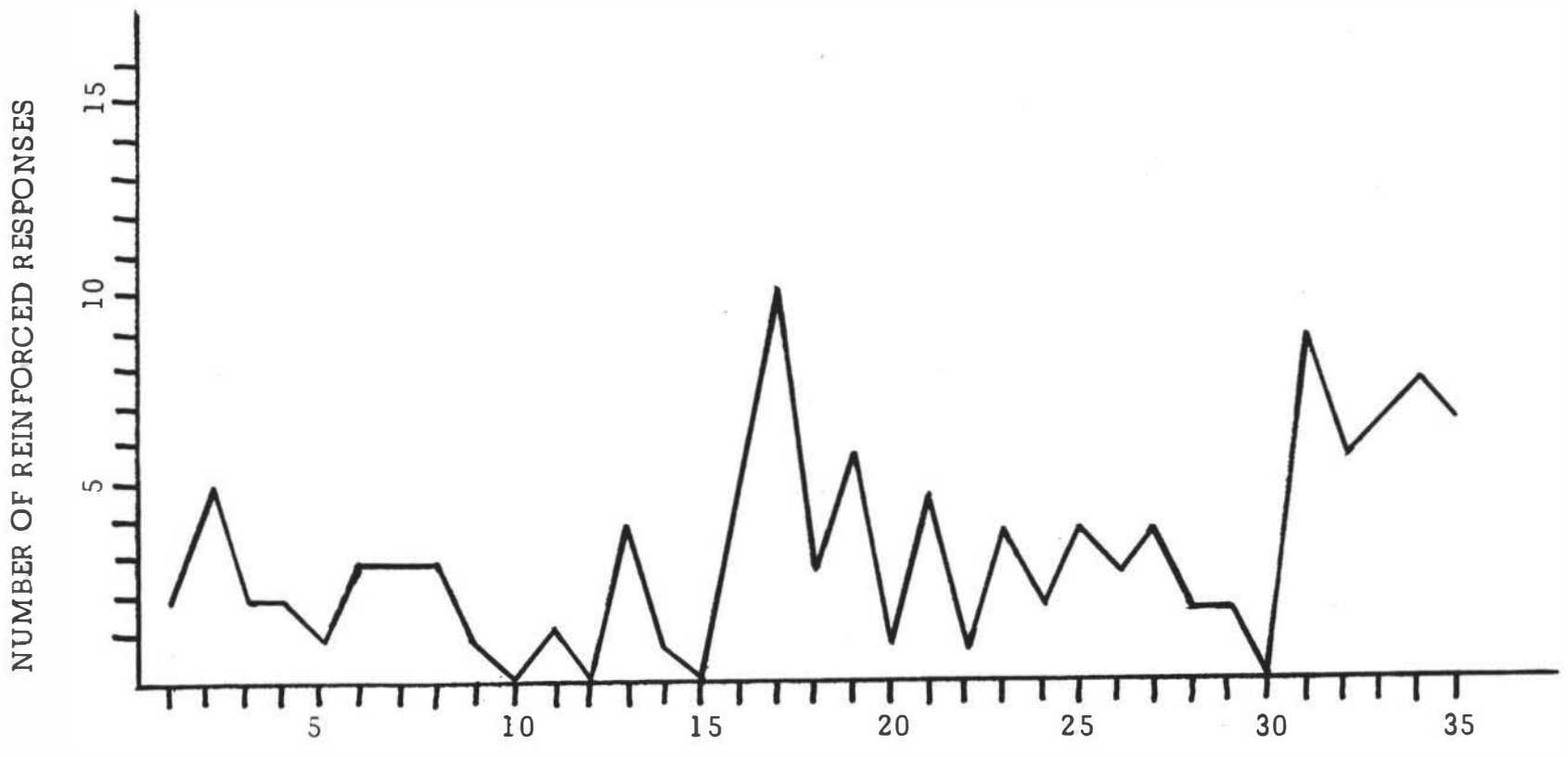
Graph 6: Stimulus word, "brown". The high reinforcement level of the beginning sets demonstrates that learning has been carried over from the preceding stimulus word. This curve presents a picture similiar to that seen in Graph 5, although the task is not stabilized as quickly. Both Graphs 5 and 6 indicate that these contexts have been stabilized and that the individual is ready to move on to other contexts.

This subject shows very little intra-subject variability from one context to the next.

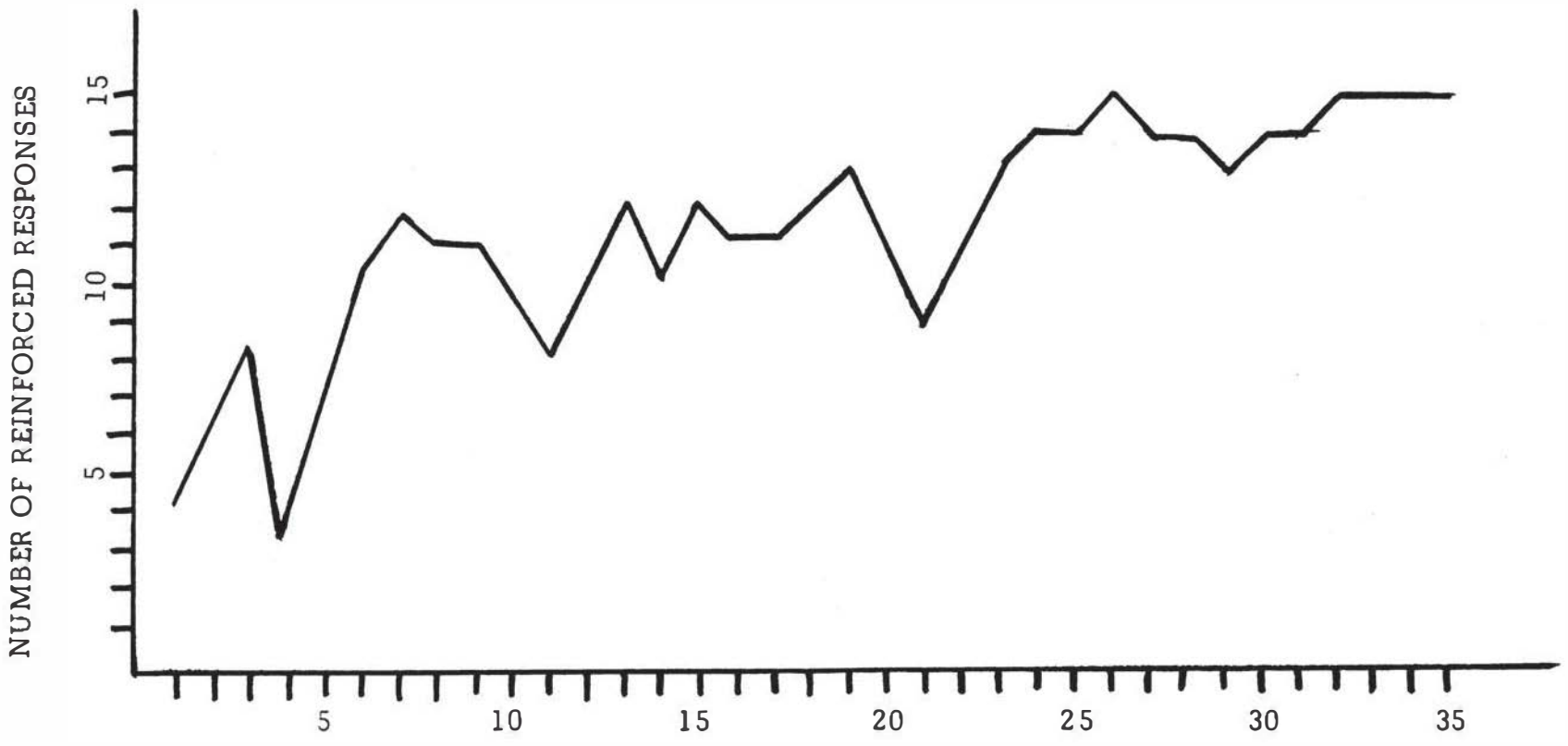
Graph 2.-- Learning Curve of Subject 1 for the Stimulus Word "Three".



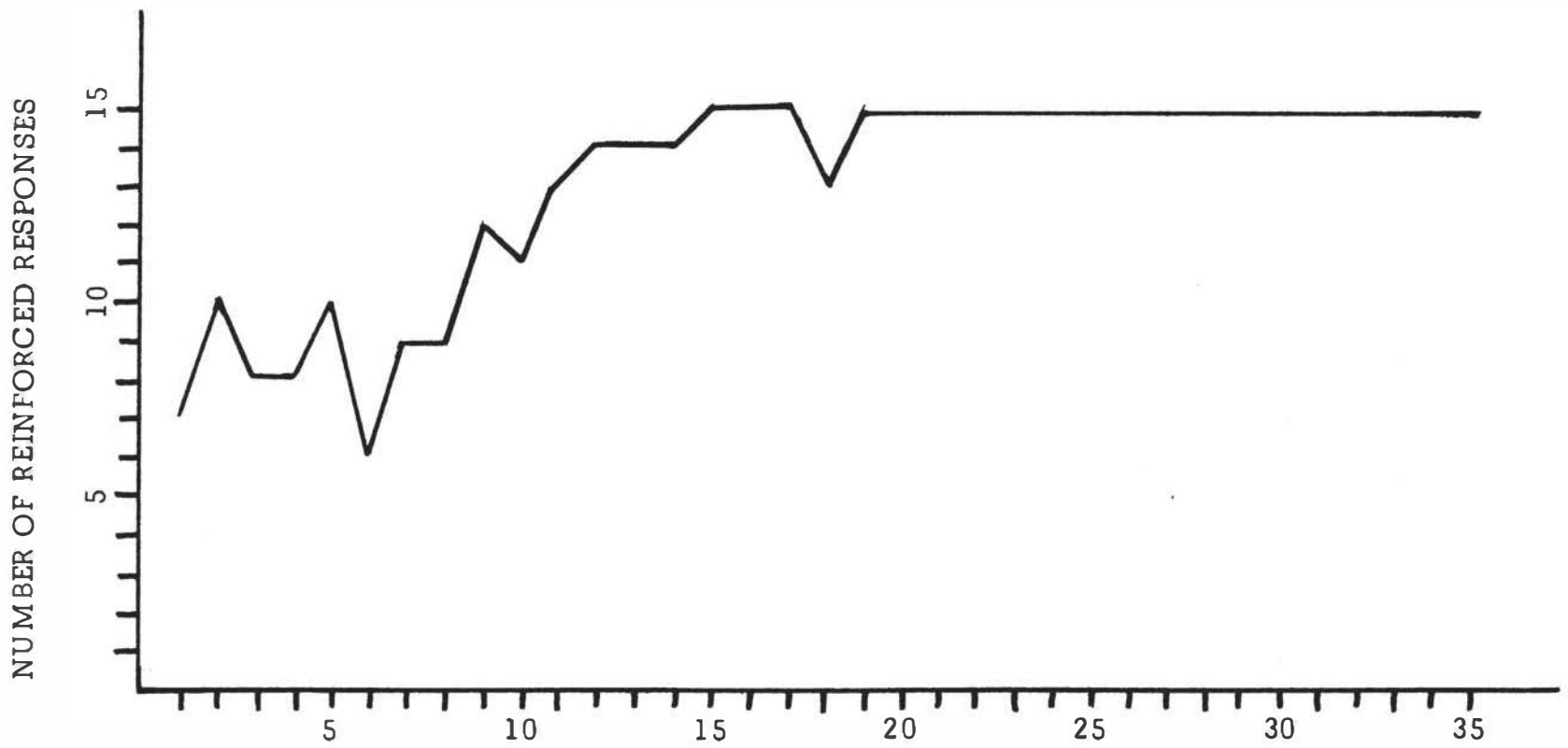
Graph 3.-- Learning Curve of Subject 1 for the Stimulus Word "Brown".



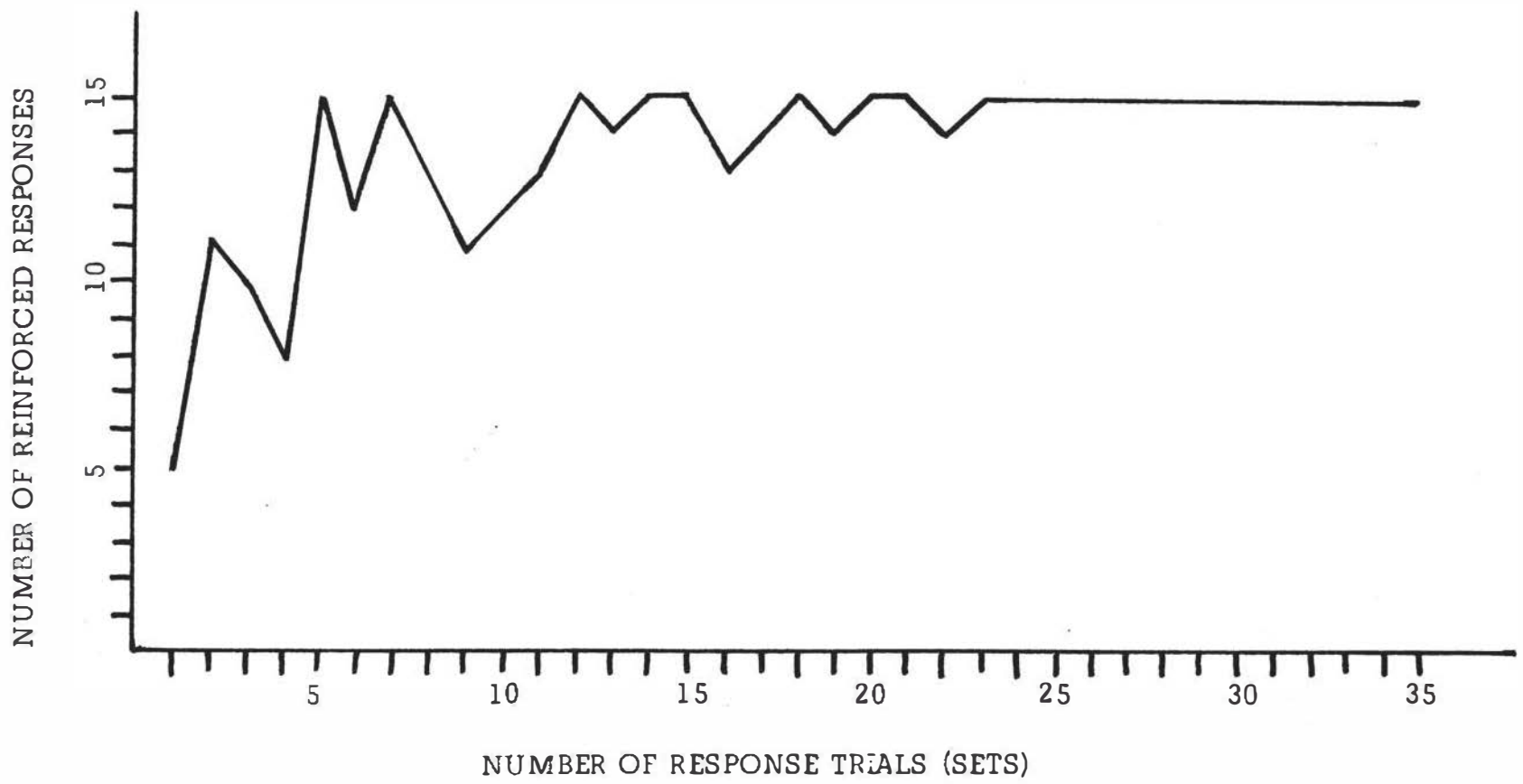
Graph 4.-- Learning Curve of Subject 2 for the Stimulus Word "Three".



Graph 5.-- Learning Curve of Subject 2 for the Stimulus Word "Pretty".



Graph 6.-- Learning Curve of Subject 2 for the Stimulus Word "Brown".



Subject Three

Graph 7: Stimulus word, "three". An s-shape curve can be seen in this graph. A short tail illustrates the fact that the subject began to learn the task rather quickly. The individual began to stabilize his productions after the 25th set but experiences a slight dip in terms of the number of reinforced responses before he once again stabilizes his productions.

Graph 8: Stimulus word, "brown". The s-shape curve is quite evident in this graph. The tail of the curve indicates that the task is fairly new for this individual. Little learning has been transferred from the previous task. The subject is slow at first in acquiring the articulatory skills needed but he makes adjustments and reaches a high level of reinforcement. However, he is unable to maintain this level and the number of reinforced responses decreases slightly. In the final sets the subject once again makes readjustments and his number of reinforced responses is increased.

Graph 9: Stimulus word, "pretty". This curve is almost identical to the curve seen in Graph 8 in terms of learning and the shape of the curve. A small amount of learning appears to have been transferred between these latter tasks as a higher number of responses are reinforced in the initial sets of the task for the word "pretty".

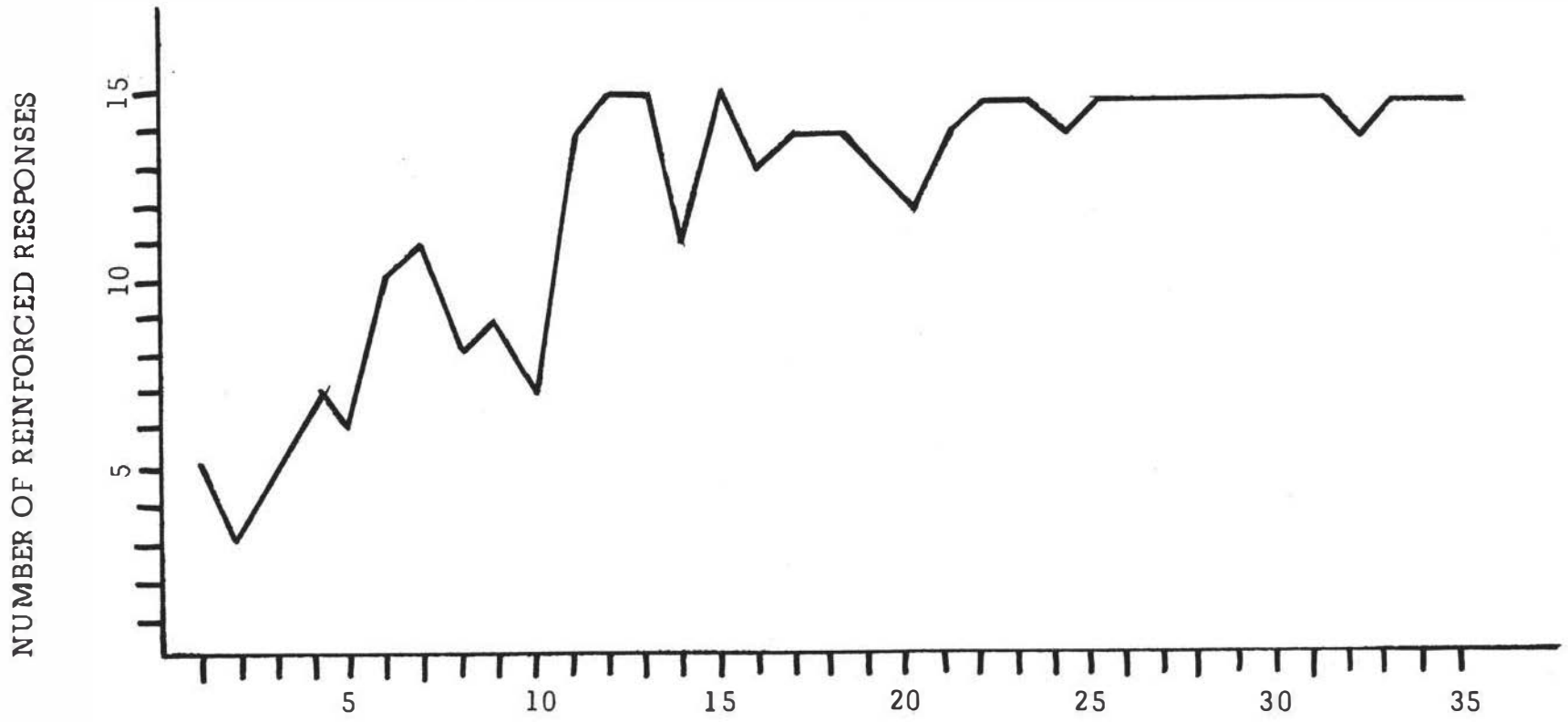
Intra-subject variability for this subject is minimal.

Subject Four

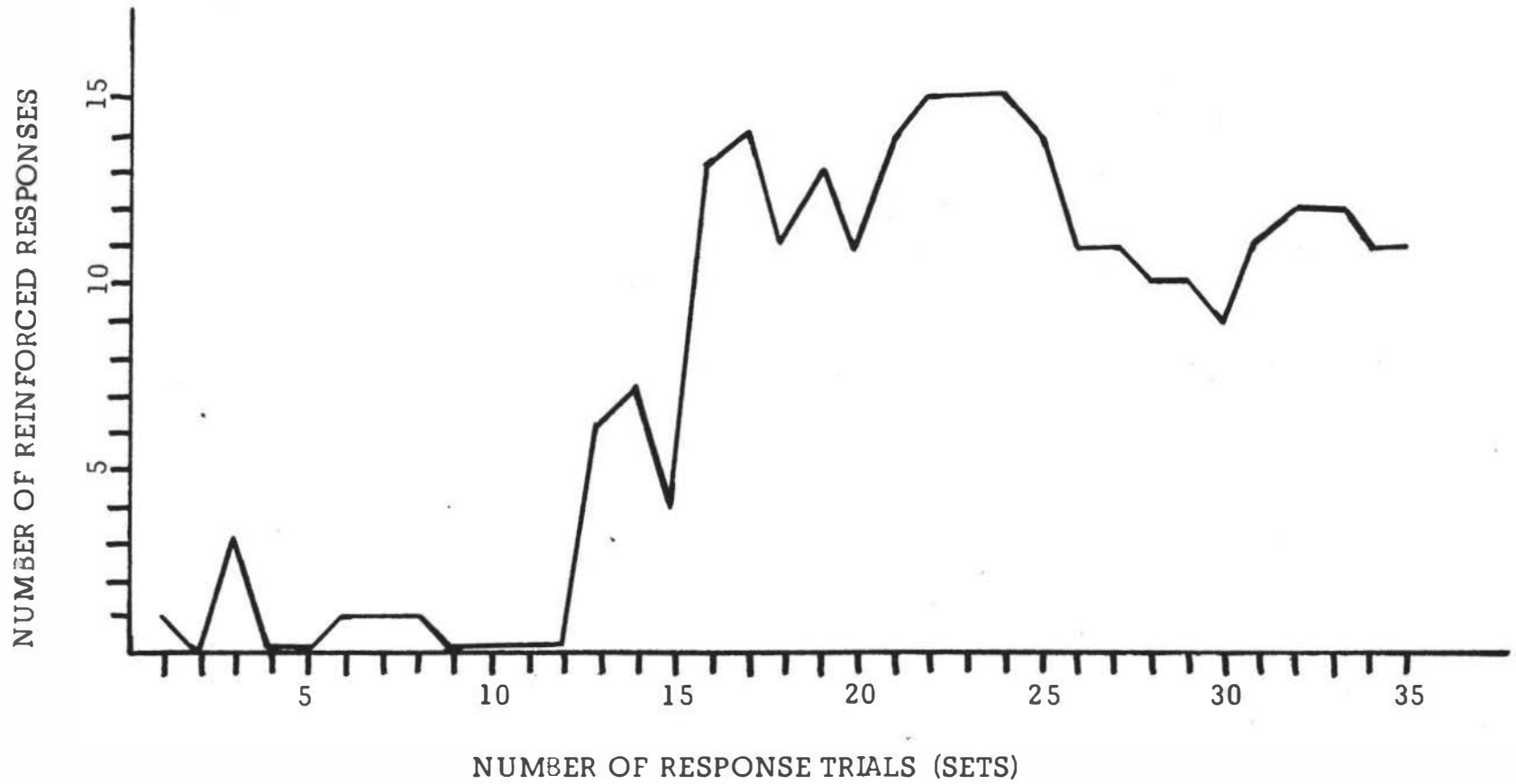
Graph 10: Stimulus word, "pretty". The curve has a short tail and variability is present. Stabilization occurs after Set 27 and the individual is prepared to move on to a new context.

Graph 11: Stimulus word, "brown". A short tail and variability are evident throughout the 35 sets. Readjustment is continually taking place and there is a consistent gradual climb in the number of reinforced responses.

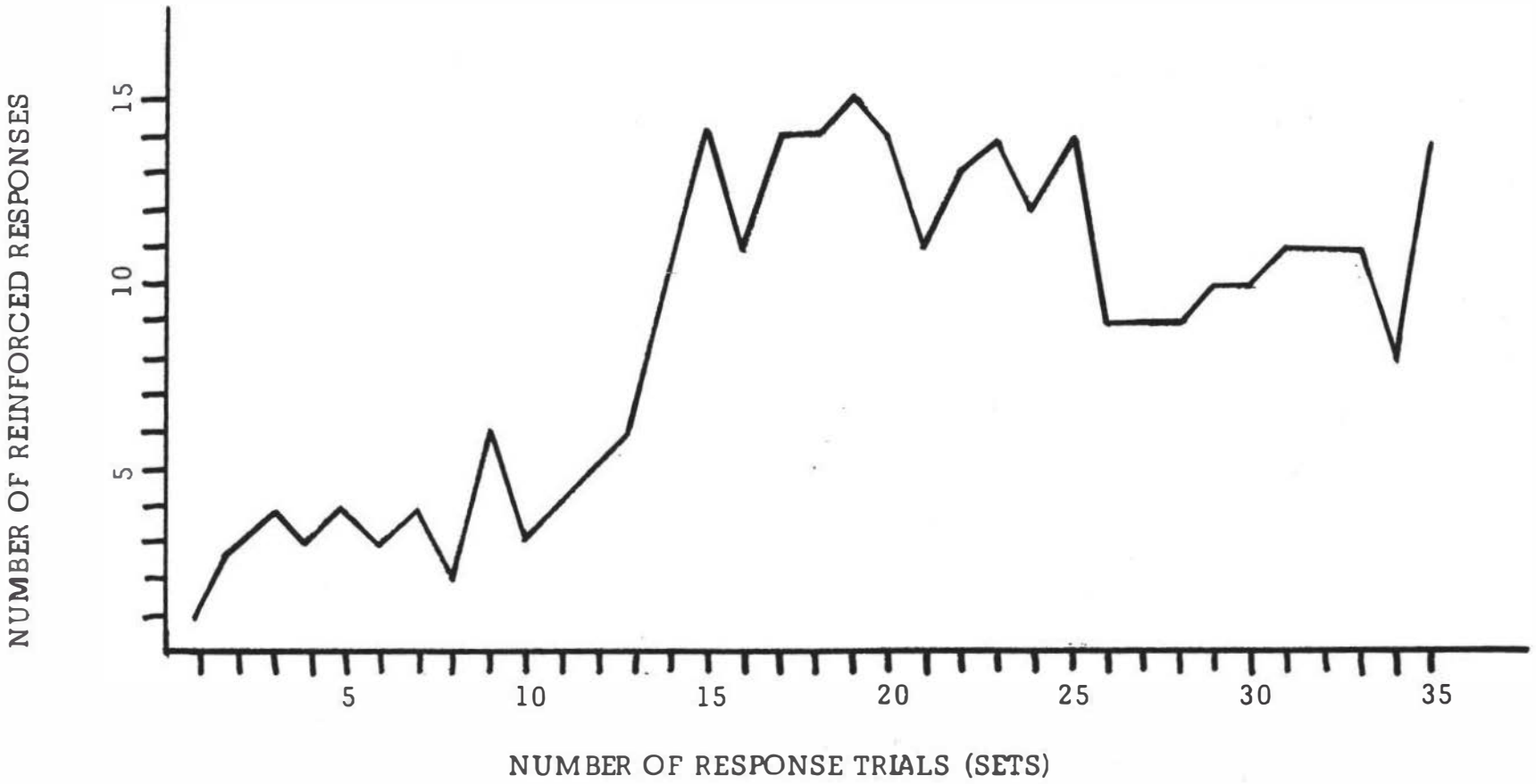
Graph 7. -- Learning Curve of Subject 3 for the Stimulus Word "Three".



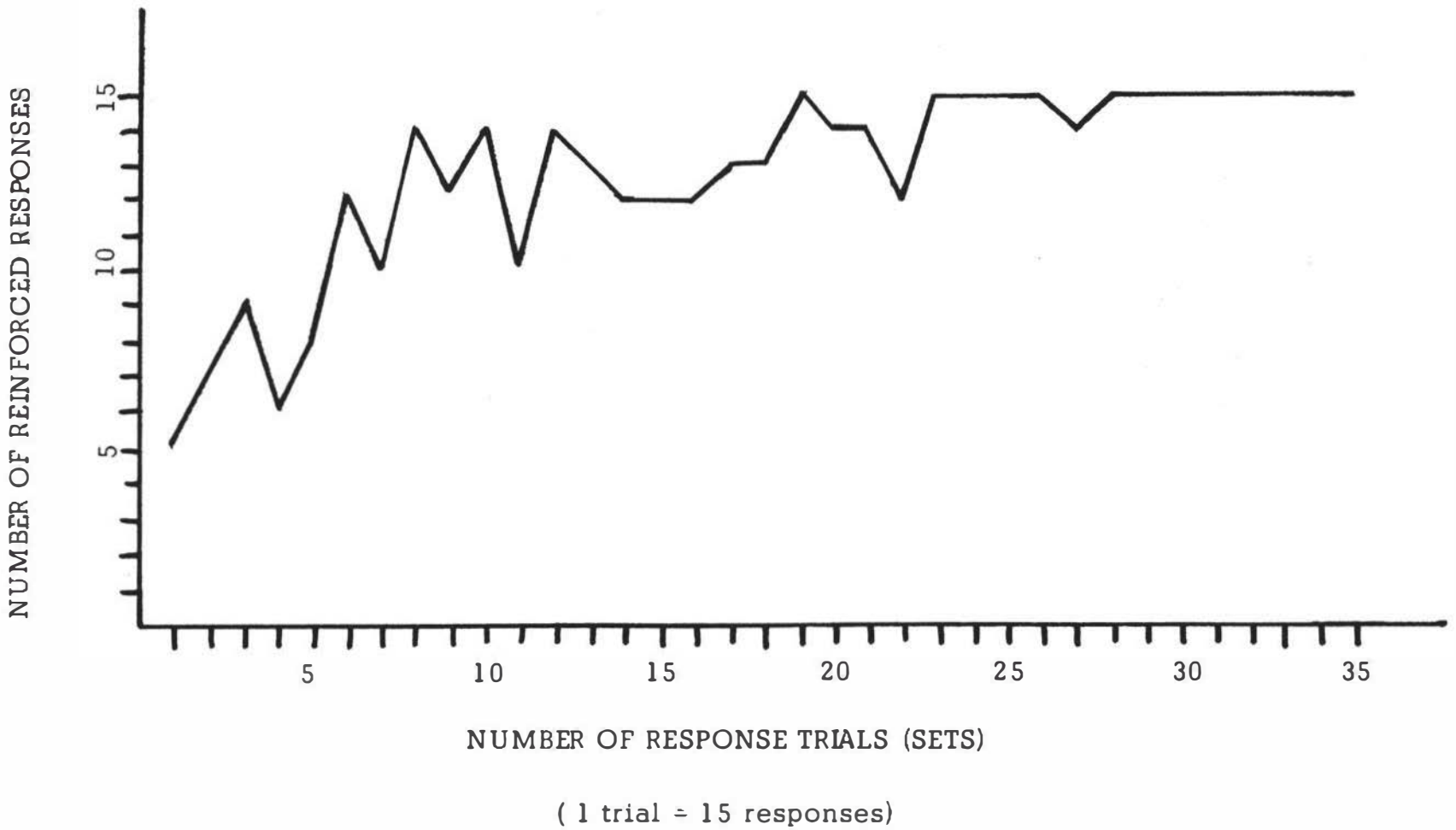
Graph 8.-- Learning Curve of Subject 3 for the Stimulus Word "Brown".



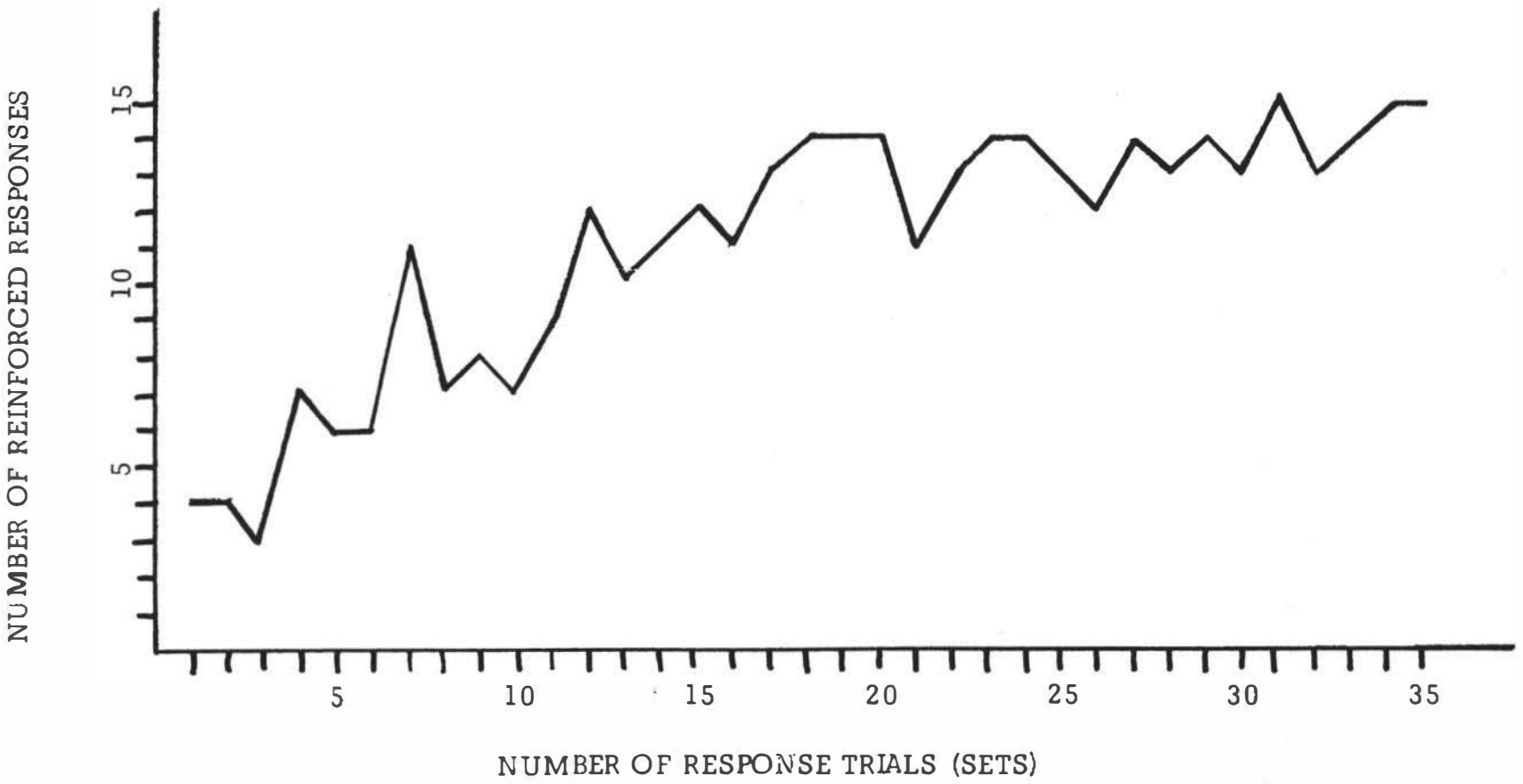
Graph 9. -- Learning Curve of Subject 3 for the Stimulus Word "Pretty".



Graph 10.-- Learning Curve of Subject 4 for the Stimulus Word "Pretty".



Graph 11.-- Learning Curve of Subject 4 for the Stimulus Word "Brown".



Graph 12: Stimulus word, "three". The curve is essentially the same as the curve seen in Graph 11.

Intra-subject variability is essentially absent for this individual.

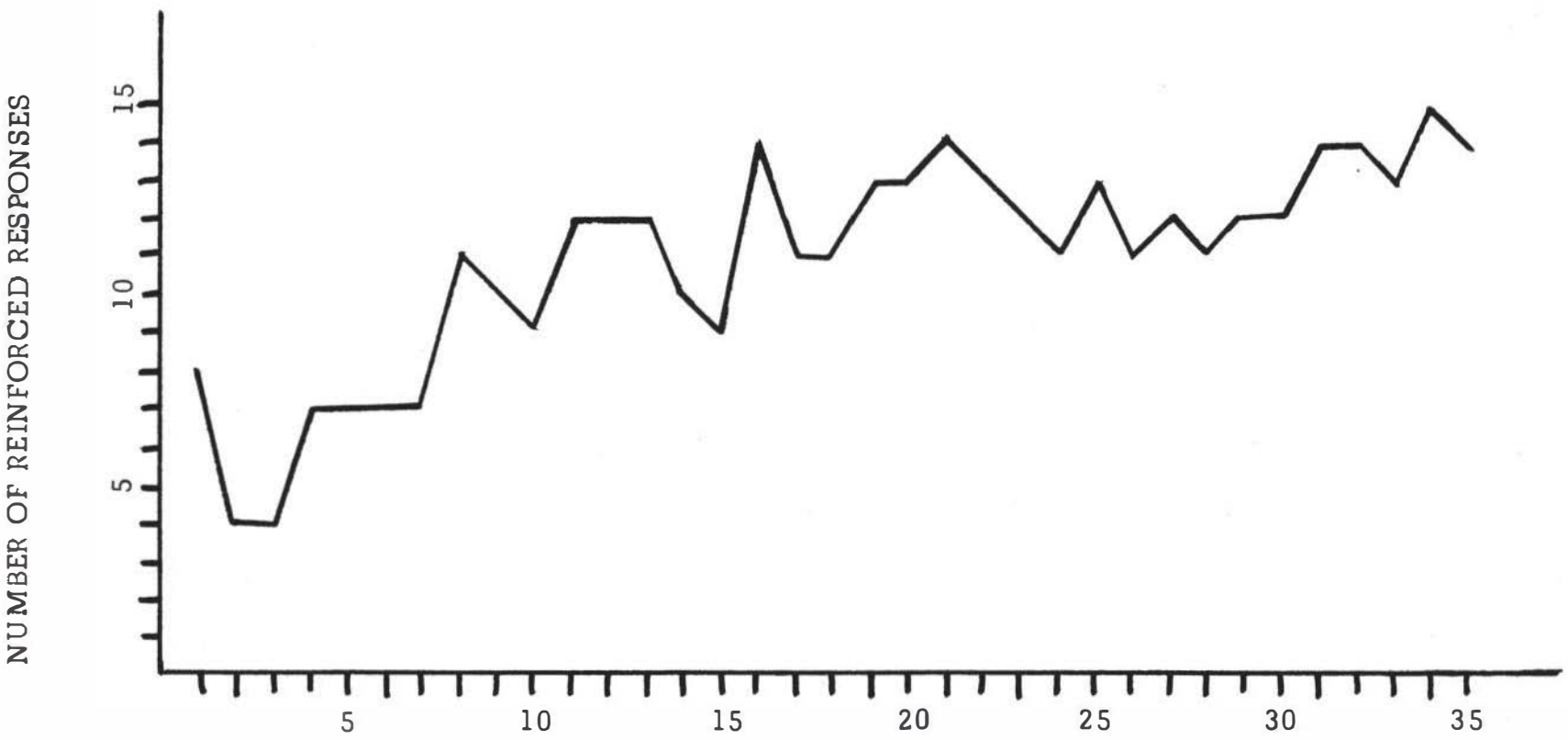
Inter-subject Learning Curve Analysis

Stimulus word, "pretty": The curves for this stimulus word are represented in Graphs 1, 5, 9 and 10 for Subjects 1, 2, 3 and 4 respectively. Each of the four curves has an s-shape. The s-shapes are much more prominent in Graphs 1 and 9 as opposed to Graphs 5 and 10 which have slight s-shape curves. Graphs 5 and 10 are very similiar in that both individuals gained high levels of reinforcement throughout the curves, learned the task fairly quickly and stabilized their productions in the concluding sets. Graphs 1 and 9 approximate one another in terms of learning curves, although Graph 9 illustrates an overall higher number of reinforced responses for the task.

Stimulus word, "three": The learning curves for Subjects 1, 2, 3 and 4 are seen in Graphs 2, 4, 7 and 12, successively. Inter-subject variability is essentially absent among subjects 2, 3 and 4, as observed in Graphs 4, 7 and 12. A slight s-curve, considerable variability and a gradual progression in an upward direction is evidenced in each of these graphs. Subjects 2 and 3 eventually stabilize their productions. The learning curve of Subject 1 is not analogous to the others as it is highly variable and the reinforced responses appear to be gained on a contingent basis.

Stimulus word, "brown": Graphs 3, 6, 8 and 11 represent the word "brown" for Subjects 1, 2, 3 and 4, consecutively. A considerable amount of inter-subject variability is present for this stimulus word. Graphs 6 and 11 are the most parallel of the four curves, in that both make gradual but continuous progress in terms of the number of reinforced responses. Subject 2, Graph 6, eventually stabilizes his

Graph 12.-- Learning Curve of Subject 4 for the Stimulus Word "Three".



productions whereas Subject 4, Graph 11, does not. The learning curves in Graphs 3 and 8 resemble one another in the initial portion of the tail only. Subject 1, Graph 3 has a more difficult time in learning the task than does Subject 3, Graph 8, as is evidenced in the number of total reinforced responses. The learning curves of Subject 2 and Subject 4 are almost identical in every instance of comparison. The learning curves of Subject 1 and Subject 3 were not analogous to one another nor to the latter curves on an overall basis.

Advantages of Charting Learning Curves

During the course of this investigation, it was noted that charting an individual's responses during the therapy sessions was a simple yet systematic way to measure therapy progress. Charting gives both the clinician and the individual a visual and concrete indication of progress and can serve as an motivational device for the individual. Furthermore, charting of responses can aid the clinician in the following ways:

- indicates if transfer of learning is occurring.
- indicates the amount of learning variability.
- indicates the rate of learning.
- indicates performance goal achievement.
- indicates when task changes are needed.
- allows the clinician to compare the learning curves for different tasks.
- indicates the effectiveness of the therapy program.
- accumulated learning can be seen on a systematic basis.

Thus, charting of responses can aid the clinician in many ways and should be integrated more often into therapy programs.

Summary

The findings from this chapter may be summarized as follows:

1. Unless a degree of varying stimulability is present, therapy can be initiated with the /pr/, /br/ or /θr/ blend.

2. The subjects who participated in this study showed very little intra-subject variability from one blend context to the next.

3. Charting of responses is a simple, systematic and worthwhile way to measure therapy progress.

Implications

It is highly recommended that this study be replicated in order to further delineate the role of frequency of occurrence and articulation ability. It is also suggested that a greater frequency of occurrence spectrum be utilized. Future research with other phonetic contexts and varying levels of misarticulation could also prove useful.

CHAPTER V

SUMMARY AND CONCLUSIONS

The purpose of this study was to analyze the responses of four children with misarticulations of the /r/ blends. In particular, the /r/ blends as contained in high, middle and low frequency of occurrence initial stressed blend contexts were studied. Those contexts studied were: "pretty", "brown" and "three", respectively. Specifically, the following questions were posed at the onset of this study:

1. Is there a statistically significant difference in the acquistion of the /r/ phoneme as contained in high, middle and low frequency of occurrence initial stressed blend contexts?

2. What is the resulting rank order of the high, middle and low frequency of occurrence initial stressed blend contexts of /r/?

Four children were selected as subjects for participation in this investigation. They conformed to the five criteria of age, hearing, education, misarticulation of the /r/ phoneme as contained in blends and amount of previous therapy.

Nineteen children met the criteria for subject selection. They were each given a twenty-two item screening test. Sixteen of the screening items were foil words. The remaining six words examined the /r/ phoneme as contained in high, middle and low frequency of occurrence initial stressed blend contexts. There were two words each for the /pr/,

/br/, /θr/ contexts. The test words for these contexts were "pretty" and "prove" for /pr/; "brown" and "break" for /br/; and "three" and "through" for /θr/. Those children who substituted or distorted the /r/ phoneme in two out of two of these contexts qualified for participation in this study.

In order to establish inter-examiner reliability four judges were selected to score a therapy session included in this investigation. Their scores were evaluated in light of the examiner's score of the subject's responses. The inter-examiner reliability percentage yielded was 98%.

Each of the four subjects were seen on an individual basis twice a week for four consecutive weeks. Each session was twenty minutes in length. "Pretty", "brown" and "three" were selected as the therapy words and were recorded three times consecutively on blank language master cards. Initially, the words were presented to the subjects randomly but the order was held constant thereafter. Each stimulus card was presented to the subject three times. The subject then responded by saying the word fifteen times. This procedure was repeated a total of five times for each stimulus word. Thus, there was a total of fifteen sets for all three stimulus words per session. The examiner judged the responses as correct, correct in terms of approximation for shaping or incorrect. The former conditions were not differentiated and were reinforced with the presentation of a light. The reinforced responses for each of the fifteen sets were charted by the examiner.

A Kruskal-Wallis H Test of Significant Difference was calculated by using proportionate decimal values. The H value yielded was 1.84. This was not statistically significant at the .05 level of confidence; therefore, the null hypothesis was accepted. Hence, the results indicated that statistically significant differences in the rate of acquisition for the three /r/ blend contexts used in this study do not exist. Therefore, any of the three contexts could be used to initiate therapy, unless a varying degree of stimulability is present for a given context.

The results of this study substantiated the results found by Ettinger (1973). She found no statistically significant differences in the rate of acquisition for the three most frequently occurring single /r/ contexts.

The Leonard and Ritterman study was not supported by the present investigation. However, the two studies were not directly comparable since they involved different phonemes, different levels of measurement, different word frequency values and different response tasks.

Conclusions

The following conclusions were drawn from this investigation:

1. There are no statistically significant differences in the rate of acquisition for the /r/ phoneme as contained in /pr/, /br/ and /θr/ blends.

2. The /pr/, /br/ and /θr/ blends did not rank order themselves significantly.

3. Intra-subject variability was minimal for each of the four subjects who participated in this study.

4. Transfer of learning occurred for some contexts for two of the subjects in this study.

5. Due to the narrow frequency of occurrence spectrum, the /r/ blends employed in this study may have been of a high frequency of occurrence nature.

6. The results of this study indicate that any of the three contexts used in this study can be used to initiate therapy.

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