1999

The relation between parental attitudes and cochlear implant benefit in eight and nine year-old children

Danielle Pennel

The Relation Between Parental Attitudes and Cochlear Implant Benefit in Eight and Nine Year-Old Children

by

Danielle Pennel

Advisor: Ann Geers, Ph.D.

Central Institute for the Deaf
Washington University
Independent Study
April, 1999

Profoundly deaf children who use cochlear implants vary in their spoken word recognition skills. Research has found that many children are receiving valuable speech information through their cochlear implants. A study by Robbins et al. in 1997, found that children who received a cochlear implant exceeded predicted values for language acquisition. Some possible explanations described were that the implant had a global, multisensory effect on language learning, or that the implant allowed the child to acquire language incidentally, through the overhearing of everyday conversations. Another study by Fryauf-Bertschy et al. in 1997, concluded that most children derive benefit from their cochlear implants for speech perception tasks. Yet, some perform very well, while others demonstrate limited use of their hearing. Research by Geers and Brenner in 1994, stated that benefit from cochlear implant use was first apparent in the closed-set perception of vowels, but after three years of use, one third of the children in their study attained some open-set speech perception.

This study focused on parents in order to find out how the child is performing with their cochlear implant on a daily basis. Any open-set speech perception test which is given to the child in a clinical setting will have limitations. The interpretation of speech depends upon the child's linguistic skills, their willingness to guess, and their ability to fill in missing bits of auditory information (Fryauf-Bertschy et al., 1997). Therefore, the parental responses are a valuable resource in order to understand the benefits of cochlear implants for young children.

Most studies that involve the parents of children with cochlear implants concern the parents' expectations for the cochlear implant. If expectations are set too high,

then it would have a negative impact on the family's adjustment to the device and to the development of the child (Kampfe et al., 1993). The parents would not be satisfied with the outcome, regardless of the level of competence that their child attained from the cochlear implant. Bertam (1995) suggests that the parents be told that not all children with a cochlear implant will achieve a high level of open-set speech recognition. Each child will require intensive speech and hearing training from teachers, therapists and family. Knuston (1997) maintained that if there is a good relationship between a parent and their child, then it would facilitate the parent's effectiveness in ensuring active implant use by the child.

Some research found that parent's expectations for cochlear implant use were realistic. The expected and realized advantages included "improvements in environmental sound perception, speech perception, speech production, and life-style" (Kelsay and Tyler, 1996). A 1990 study by Cunningham, found that 75% of 132 parents of children with cochlear implants were satisfied with the child's performance. Most of these parents indicated that the implant had a greater effect on speech production than speech perception.

The Lexical Neighborhood Test (LNT), which was developed by Kirk et al. in 1995, is a valuable open-set speech perception test for profoundly deaf children. Most often, cochlear implant users are tested with the Phonetically Balanced Kindergarten word lists (PB-K), which was developed by Haskins in 1949 (Kirk et al., 1999). Difficulties arise with the PB-K when attempting to distinguish among children with varying spoken word recognition. This is because all their scores usually cluster in a

restricted range near 0% correct (Kirk et al., 1995). Although these scores are low, the children often have good performance during daily activities. Therefore, the child's spoken word recognition skills are underestimated by the PB-K word lists. One possible explanation for this is due to the test item selection being constrained by phonetic balancing. The resulting lists may contain words that are unfamiliar to young deaf children who usually have very limited vocabulary (Kirk et al., 1999).

The LNT is based upon the theory that hearing impaired children organize and access spoken words from their long-term memory similarly to children with normal language development. In this paradigm, words are "organized into 'similarity neighborhoods' based on their frequency of occurrence (i.e., how often words occur in the language) and the density (i.e., acoustic-phonetic similarity) of words within the lexical neighborhood" (Kirk, 1995). A neighborhood is comprised of words that are "neighbors" because they differ by one phoneme from the target word. Therefore, words with many lexical neighbors are in "dense" neighborhoods, and those with few neighbors are in "sparse" neighborhoods. This study presented the subjects with the LNT easy word list in Appendix A, which means the words are high in frequency and from "sparse" neighborhoods.

More reasons why the LNT is an accurate test for speech recognition skills were found in a recent study by Kirk et al. in 1999. It was shown that the test-retest reliability of the LNT was quite high. Also, it was suggested that the LNT is measuring the encoding, storage, retrieval, and manipulation of spoken language of the child. The authors concluded that the LNT lists may be one important predictor of a child's ability

to acquire spoken language.

This study focused on two questions about the relation between the speech perception abilities of the children and parental responses. The first question was whether parents' observations of auditory behavior coincided with formal measures of speech perception abilities. This was determined by comparing the LNT results with answers to the *Auditory Responsiveness* (Geers et al., 1997) parent questionnaire. The second question was to see what family intervention characterized children who had good speech perception. The parent responses on the *Parent Participation in Therapy* (Geers et al., 1997) questionnaire helped answer this question.

METHOD

Subjects

Central Institute for the Deaf conducted research camps in the summers of 1997 and 1998 for a total of 90 children with cochlear implants. These children were implanted when they were under five years-old and attended the camp when they were eight or nine years-old. Forty of these children were chosen for this study by their scores on the LNT. Twenty of the children with the lowest scores on the LNT (0-12% correct) and the twenty children with the highest scores on the LNT (64-88% correct) were selected. The group of children with the low LNT scores were compared to the group with the high LNT scores.

These children's parents, who also attended the camp, filled out two parental questionnaires that address the child's auditory responsiveness and their participation in the child's therapy after implantation. The responses of the parents of the twenty low

LNT children were compared to the responses of the parents of the twenty high LNT children.

Materials

The LNT is an open-set test which uses auditory cues alone. The child does not have any pictures of words to choose from, nor is told what words may be presented. The child is required to listen to one-syllable words presented recorded at 70 dBSPL in the soundfield and repeat what is said. Each child was given a list of twenty LNT Easy Words (Appendix A) while using their cochlear implant. The Easy Word list consists of vocabulary items that occur more frequently in everyday speech and have few words that sound similar to the target word (Kirk et al., 1995). Therefore, the word may be more easily identified. The child's scores were based on the percentage of the number items correct. From these scores, the child's speech perception abilities were inferred. A low score showed poor speech perception abilities and a high score showed good speech perception abilities.

The *Auditory Responsiveness* questionnaire contained eleven statements that covered such areas as the child's ability to respond to quiet sounds, discriminate between sounds, and to understand speech. For this questionnaire a parental response of 1 was for Always and proceeded to a response of 5 for Never.

The *Parent Participation in Therapy* questionnaire included 26 statements in which the parent responded to the degree of their participation in the child's therapy during the first, second and third years following implantation and at the present time. The parents' answers could be Daily, Weekly, Monthly, Rarely, or Never. The topics

within this questionnaire included areas such as the parent helping the child with sound and speech detection, reading to/with the child, interactions with the child's teacher, family participation in therapy, correcting speech production, and education issues.

RESULTS

Auditory Responsiveness

To examine the responses from the *Auditory Responsiveness* questionnaire a frequency distribution table was created to compare the low versus the high LNT score groups (Table 1). The median response category is indicated for the low and high LNT groups. Seven of the eleven items showed a difference in the median ratings for the two groups.

Item two concerned how often the child asks to have their cochlear implant put on or puts it on themselves without being told. The median response for the low LNT group was Usually, while the high LNT group median response was Always. Similar results were found for item three. The high LNT group always inform an adult as soon as the battery has run down or when other malfunction occurs, while the low LNT group usually did so .

Item seven addressed whether the child could determine the sex of the speaker when the child could only hear, not see, them talking. The high LNT group median response was Usually, while the low LNT group median was Occasionally. Item eight, that stated whether the child responds to their name being called when not looking or in the next room, showed differences between the groups' median responses. The low LNT group had a median response at Usually, and the high LNT group median

response was at Always. Item nine asked how often the child recognizes familiar pharases and the names of common objects when only listening. The median response for the low LNT group was Usually, while the high LNT was Always.

The largest difference between median ratings was observed for item ten, which stated that the child responds appropriately to questions that are asked over the telephone. The low LNT median response was Never, and the high LNT median was Usually. Number eleven concerned whether the child understands what people have said without looking at the speaker. The low LNT group median response was Occasionally, while high LNT group median response was Usually..

Parents of both the low and high LNT groups reported that their children usually took responsibility for maintaining and storing their implant, stopped an activity to determine the source of a noise and called attention to electric signals from appliances. Both groups also reported that their child always knew the difference between speech and nonspeech by listening alone.

Parent Participation in Therapy

Responses to the *Parent Participation in Therapy* questionnaire are shown in Table 2. Median ratings are indicated for each year for both LNT groups. When the median crosses two categories, both are listed (e.g. Daily/ Weekly). Of the 26 items, a difference during at least one of the years (Year 1, 2, 3 and Current) occurred in 14 items. Each of the responses for these 14 items will be discussed more in depth.

For item five, which addressed whether the parent expected the child to demonstrate understanding of most words in long sentences, the low LNT group

responded Rarely, while the high LNT group responded Monthly for Year 1, Weekly for Year 2. This may suggest that the parents of good speech perceivers expect more results from their child soon after implantation.

Item six asked how often the parent alerted their child to the source of a sound or to the person talking. The differences between groups occurred in Year 3 and Current. The median low LNT response was Daily and the median high LNT response was Weekly. Possibly children who have good speech perception did not need to still be alerted to sounds because they could detect it by themselves.

Item seven, which addressed how often the parent had the child choose pictures or give objects that were named, showed median differences for the Current time period. The low LNT group had a median response of Daily and the high LNT group had a median of Monthly/ Rarely. This was a large difference of response between the groups. An explanation for this extreme difference could be that this basic teaching task was now too simplistic for the good speech perceivers. The children with poor speech perception may still have needed this task for improving their speech understanding.

Item eight concerned how often the parent sang songs or recited nursery rhymes to and/ or with their child. Differences between groups occurred in Year 1 and Year 2. For both years, the low LNT group had a median response of Monthly/ Rarely while the high LNT group had a median response of Daily. This could suggest that this type of auditory stimulation right after implantation may have helped improve the child's speech perception abilities.

Item nine addressed the frequency the parent read to their child. The only difference between groups occurred in Year 3, where the low LNT group responded Weekly and the high LNT median was Daily. The low LNT group did not maintain their Daily routine, which was the response for preceding years on this item.

Item eleven concerned how often the parent and child discussed stories the child read or that had been read to the child. There were differences between the groups for every year. The low LNT group had Rarely for Year 1 and 2, and Weekly for Year 3 and Current. The high LNT group had Daily for all years. Item twelve also had differences between groups for every year. This item addressed how often the parents checked their child's understanding of stories that the child read or that had been read to the child. The low LNT group had Rarely for Year 1, Monthly for Years 2 and 3, and Weekly for Current. The high LNT group had Daily for all the years. A difference this extreme between both group's responses could have been a very significant factor in developing good speech perception. It is suggested that when the parent discussed and checked the child's understanding of stories, the child's speech perception ability may have been enhanced.

Some items on this questionnaire addressed the parent working on the child's listening and language at home. The statement for item ten referred to the parent having a specific place and/ or time and/ or routine set aside for listening or language. Differences occurred between groups for Years 1, 2, and 3. The low LNT group had Weekly for these years and the high LNT group had Daily. This may imply that it is important for the parent to bombard the child with organized listening/ language

activities at home immediately after implantation.

Item seventeen asked how often the parent gave family members ideas for helping improve the child's listening/ language. For Years 1, 2, and 3, the low LNT group responded Weekly while the high LNT group responded Daily. This may also have shown the importance of listening and language activities on a daily basis at home.

Item nineteen addressed whether the parent kept written records of their child's progress in listening and language. The only difference was in Year 3, where the low LNT group response was Monthly and the high LNT group response was Rarely. This difference may not have been significant since it occurred in only one year. Yet, it could have shown that the high LNT group progressed very quickly in their listening and language abilities and therefore the parents could not maintain an accurate, updated record.

The last four items which showed differences between the low and high LNT groups concerned the parent's interactions with the child's teacher. Item thirteen was concerned with how frequently the parent asked the child's teacher to suggest activities that would help the child. The differences between groups occurred in Years 1, 2 and Current. For Years 1 and 2, the low LNT group responded Weekly and the high LNT group responded Daily. In the Current condition, the low LNT group had a response of Weekly and the high LNT group had Monthly. The difference for Current may be because the parents of the high LNT group now felt secure and confident enough as their role of a home teacher that they did not need to rely on suggestions from the

child's teacher. These differences in Years 1 and 2 were also shown for item fourteen, which asks whether the parent knew the teacher's goals for their child. The low LNT group response was Weekly and the high LNT group was Daily for these years. The Year 1 and 2 differences for items thirteen and fourteen may imply that when there is a good, daily communication with the child's teacher after implantation, then the child can benefit maximally. This interaction with the child's teacher could help the parent learn the best ways to teach skills to their child at home.

Item fifteen rates how often the parent observed their child working with their teacher. For Year 3, the low LNT group response was Monthly, while the high LNT group was Weekly. This may suggest that through observing their child at school, even a few years after implantation, the parent could learn ways to best teach their child at home. The final item that showed a difference between LNT groups was item sixteen. It addressed how frequently the parent told their child's teacher new things that the child learned at home. In the Current condition, the low LNT response was Weekly and the high LNT response was Monthly. As with the Current condition difference of item thirteen, the parents of the high LNT group may not have found it as important as before to communicate frequently with the teacher about their child's progress.

DISCUSSION

The results from the two parental questionnaires showed some significant differences between the low LNT group and the high LNT group. These differences helped to answer the two questions of this study.

On the *Auditory Responsiveness* questionnaire, differences between groups

were found in the seven of the eleven areas covered. For these topics, the high LNT group had the lesser amount of difficulty performing them. There could be two reasons to explain this. First, the activities in these seven areas helped the child to obtain good speech perception skills. Second, the child already had good speech perception through use of their cochlear implant and therefore performed well in these areas. This could suggest that focus on these areas could help the child's parents and therapists teach good speech perception skills or monitor the speech perception abilities of the child.

It should be noted that there were areas in which there were not differences between the low and high LNT groups. Both groups took responsibility for maintaining and storing their implant, stopped a quiet activity to listen to a new sound and called attention to new sounds, such as signals from electrical appliances. These groups also could differentiate between speech and non-speech trough listening alone. These responses indicate that even those children who did not achieve open-set speech perception received measurable benefit from their cochlear implant in their daily life.

One of this study's questions was whether the parents's observations of auditory behavior coincides with formal measures of speech perception abilities. This could be answered through the *Auditory Responsiveness* questionnaire. For a majority of the items on this questionnaire, the parents perceived different auditory responsiveness skills for the low LNT group when compared to the high LNT group. Both the LNT and this questionnaire were able to separate out the good and the poor speech perceivers. It could therefore be stated that the formal audiologic measures of speech perception

accurately measure the child's skills in the real world. This implies that the LNT scores alone may be an accurate predictor for the majority of areas in auditory responsiveness.

The *Parent Participation* questionnaire also showed differences between the low and high LNT groups. The results that are discussed below address this study's final question of what family intervention characterizes children who have good speech perception. This intervention may have helped promote the child's speech perception skills or just reflected the speech perception abilities of the high LNT group. Either way, certain family interventions were prevalent with the children who had good speech perception abilities.

These results could be very important when training a parent ways to have their teach skills to a newly implanted child. One of these differences showed that parents of the high LNT group expected their children to demonstrate understanding of most words in long sentences more often after receiving a cochlear implant. Possibly in the beginning, these parents pushed their children to comprehend speech more or the child was able to do this activity because they were receiving valuable speech information through their cochlear implant. Parents may be taught that it is not wrong to expect these results so quickly, as long as the expectations are not too high for the child. Two other items that had differing results involved the parents having the child choose pictures that are named and alerting the child to the source of a sound. For both of these, the high LNT group did not need to do the activities as often in the later years. This may be because they had conquered these particular skills. Parents should be

advised to continue these activities until the child appears competent at them.

The most significant results that separate the low and high LNT groups were discussing stories and checking the child's understanding of stories that were read to the child or that the child read. The high LNT group were doing this on a daily basis, while the low LNT group varied from a weekly basis to rarely. Parents should be taught that this is a simple, yet critical, activity that should be performed with their child from when they are implanted. The child's speech perception abilities could be recognized or strengthened during story time. Differences were also found between the groups in how often the parent read stories and sang songs to/ with their child. These are also basic activities that a parent could employ.

This questionnaire also found differences for therapy the parents did at home. The high LNT group parents more often had a specific routine for listening/ language practice, kept a written record of the child's progress, and gave family members ideas for helping with the child's listening/ language skills. These activities were more prevalent with the high LNT group in the years immediately following implantation. Possibly, it could be suggested to parents of newly implanted children that these activities at home are important for the development and monitoring of the child's speech perception abilities.

The last area where this questionnaire had differences between the low and high LNT groups involved the child's teacher. More specifically, the items addressed whether the parent asked the teacher for activities to help the child, knew the teacher's goals for child, observed the child with their teacher, and told the teacher new things

the child had learned at home. These four activities are ones that could be applied to parents of any child. Yet, they may be more important when the child involved has special needs. A working relationship with the child's teacher should be stressed to parents of children with a new cochlear implant.

CONCLUSIONS

The two questionnaires that were used in this study found certain areas that showed differences between the children with the low and high LNT scores. This helped answer the two questions that this study aimed for. First, the results from the *Auditory Responsiveness* questionnaire did show that parents' observations of their child's auditory behavior coincided with the formal measures of speech perception abilities (the LNT). Second, the *Parent Participation in Therapy* questionnaire found specific family interventions that characterized children who have good speech perception.

Listed below are these areas which may be used to help parents improve their child's speech perception abilities. These suggestions should be added to the child's current speech perception therapy that is being used. The areas preceded by an asterisk indicates where significant differences were found between the low and high LNT groups.

•Reinforce the child when they do the following:

- •Asks to have their cochlear implant put on/ or does it themselves
- •Informs an adult when the battery has run down or when the cochlear implant has malformed

- Focus on these topics during listening/ language therapy:
    - Determine sex of speaker by listening alone
    - Respond to name when not looking at speaker
    - Recognize familiar phrases and names of common objects by listening alone
    - *Understand questions asked over the telephone
    - Understand people without looking at the speaker
- Expect the child to demonstrate understanding of most words in long sentences during the first years after implantation
- Have a specific daily routine for listening/ language practice at home
- Involve family members in helping improve the child's listening/ language skills each day
- Sing songs or recite nursery rhymes to and/ or with child every day
- Read to child each day
- *Discuss stories the child reads or have been read to child on a daily basis
- *Check the child's understanding of stories the child read or have been read to child every day
- Ask child's teacher to suggest activities that will help child following implantation
- Know child's teacher's goals for child each day following implantation

REFERENCES

Bertram, B., 1995. Importance of Auditory-Verbal Education and Parents' Participation After Cochlear Implantation of Very Young Children. *Annals of Otology, Rhinology and Laryngology.* 104 Suppl. 165-167. 97-100.

Cunningham, JK., 1990. Parents' Evaluations of the Effects of the 3M/ House Cochlear Implant on Children. *Ear and Hearing.* 11 (5). 375-381.

Fryauf-Bertschy, H., Tyler, RS., Kelsay, DMR., Gantz, BJ., Woodworth, GC., 1997 Feb.. Cochlear Implant Use by Perlingually Deafened Children: The Influences of Age at Implant and Length of Device Use. *Journal of Speech, Language, and Hearing Research.* 40. 183-199.

Geers, A., Brenner, C., 1994. Speech Perception Results: Audition and Lipreading Enhancement. *The Volta Review.* 96 (5). 97-108.

Geers, A., Kozak, V., Tye-Murray, N., 1997. Auditory Responsiveness Questionnaire. Unpublished research instrument.

Geers, A., Tye-Murray, N., Kozak, V., 1997. Parent Participation in Therapy Questionnaire. Unpublished research instrument.

Kampfe, CM., Harrison, M., Oettinger, T., Ludington, J., McDonald-Bell, C., Pillsbury III, HC., 1993. Parental Expectations As a Factor in Evaluating Children for the Multichannel Cochlear Implant. *American Annals of the Deaf.* 138 (3). 297-303.

Kelsay, DMR., Tyler, RS., 1996. Advantages and Disadvantages Expected and Realized by Pediatric Cochlear Implant Recipients as Reported by Their Parents. *The American Journal of Otology.* 17 (6). 866-872.

Kirk, KI., Eisenberg, LS., Martinez, AS., Hay-McCutcheon, M., 1999. Lexical Neighborhood Test: Test-Retest Reliability and Interlist Equivalency. *Journal of the American Academy of Audiology.* 10. 113-123.

Kirk, KI., Pisoni, DB., Osberger, MJ., 1995 Oct.. Lexical Effects on Spoken Word Recognition by Pediatric Cochlear Implant Users. *Ear and Hearing.* 16 (5). 470-481.

Knutson, JF., Boyd, RC., Reid, JB., Mayne, T., Fetrow, R., 1997. Observational Assessments of the Interaction of Implant Recipients with Family and Peers: Preliminary Findings. *Otolaryngology- Head and Neck Surgery.* 117 (3:1). 197-207.

Robbins, AM., Svirsky, M., Kirk, KI., 1997. Children With Implants Can Speak, But Can They Communicate? *Otolaryngology- Head and Neck Surgery*. 117 (3:1). 155-160.

TABLE 1

AUDITORY RESPONSIVENESS

	LNT Scores	1 Always	2 Usually	3 Occasionally	4 Rarely	5 Never
1) Takes responsibility for maintaining and storing CI	Low	7	(6)	5	2	0
	High	8	(8)	2	1	1
2) Asks to have CI put on- or does it himself ☆	Low	4	(10)	6	0	0
	High	(12)	8	0	0	0
3) Informs adult when battery has run down or when CI has malformed ☆	Low	9	(6)	4	1	0
	High	(17)	3	0	0	0
4) Stops a quiet activity to determine source of noise	Low	2	(13)	3	2	0
	High	9	(5)	4	2	0
5) Calls attention to electronic signals from appliances	Low	8	(10)	1	1	0
	High	9	(7)	3	0	1
6) Knows difference between speech and nonspeech sounds by listening alone	Low	(11)	7	1	0	1
	High	(17)	3	0	0	0
7) Can determine sex of speaker by listening alone ☆	Low	0	6	(8)	3	3
	High	4	(15)	1	0	0
8) Responds to name when not looking or in the next room ☆	Low	8	(11)	0	0	1
	High	(16)	4	0	0	0
9) Recognizes familiar phrases and names of common objects by listening alone ☆	Low	6	(12)	1	0	1
	High	(15)	5	0	0	0
10) Understands questions asked over the telephone ☆	Low	0	1	3	6	(10)
	High	0	(13)	7	0	0
11) Understands people without looking at the speaker ☆	Low	0	3	(9)	5	3
	High	0	(18)	2	0	0

(○) = Median Response

☆ = Notable differences between Low and High LNT groups

TABLE 2

PARENT PARTICIPATION IN THERAPY

	LNT Scores	Year 1	Year 2	Year 3	Current
1) Plays with musical instruments, soundmaking toys, or objects with child	Low High	Daily/ Weekly Daily	Weekly Weekly	Weekly/ Monthly Monthly	Monthly Monthly/ Rarely
2) Works with child on detecting sounds (e.g. name called, telephone ring)	Low High	Daily Daily	Daily Daily	Daily Daily	Daily Daily/ Weekly
3) Gives the child opportunities to listen and show recognition of familiar words and phrases	Low High	Daily Daily	Daily Daily	Daily Daily	Daily Daily
4) Talks to child when child cannot see them	Low High	Daily Daily	Daily/ Weekly Daily	Daily Daily	Daily Daily
5) Expects child to demonstrate understanding of most words in long sentences	Low High	Rarely Monthly ☆	Rarely Weekly ☆	Weekly Weekly	Daily Daily
6) Alerts child to the source of a sound or to the person talking	Low High	Daily Daily	Daily Daily	Daily Weekly ☆	Daily Weekly ☆
7) Has child choose pictures or give objects that are named	Low High	Daily Daily	Daily Daily	Daily Daily/ Weekly	Daily ☆ Monthly/ Rarely
8) Sings songs or recites nursery rhymes to and/ or with child	Low High	Monthly/ Rarely Daily ☆	Monthly/ Rarely Daily ☆	Weekly/ Monthly Weekly	Monthly/ Rarely Monthly
9) Reads to child	Low High	Daily Daily	Daily Daily	Weekly Daily ☆	Daily Daily
10) Has a specific place and/ or time and/ or routine for listening or language practice	Low High	Weekly Daily ☆	Weekly Daily ☆	Weekly Daily ☆	Weekly Weekly
11) Discusses stories the child reads or that have been read to child	Low High	Rarely Daily ☆	Rarely Daily ☆	Weekly Daily ☆	Weekly Daily ☆
12) Checks child's understanding of stories child read or have been read to child	Low High	Rarely Daily ☆	Monthly Daily ☆	Monthly Daily ☆	Weekly Daily ☆
13) Asks child's teacher to suggest activities that will help child	Low High	Weekly Daily ☆	Weekly Daily ☆	Weekly Weekly	Weekly Monthly ☆

☆= Notable differences between low and high LNT groups

TABLE 2 (Cont.)

	LNT Scores	Year 1	Year 2	Year 3	Current
14) Knows child's teacher's goals for child	Low High	Weekly Daily ☆	Weekly Daily ☆	Weekly Daily/ Weekly	Weekly Weekly
15) Observes child working with their teacher	Low High	Weekly Daily/ Weekly	Weekly/ Monthly Weekly	Monthly Weekly ☆	Monthly Monthly
16) Tells child's teacher new things child learns or does at home	Low High	Weekly Weekly	Weekly Weekly	Weekly Weekly	Weekly Monthly ☆
17) Gives family members ideas for helping improve child's listening/ language	Low High	Weekly Daily ☆	Weekly Daily ☆	Weekly Daily ☆	Weekly/ Monthly Weekly
18) Encourages child to communicate with people outside the family and school	Low High	Daily Daily	Daily Daily	Daily Daily	Daily Daily
19) Keeps written records of child's progress in listening and language	Low High	Monthly Monthly	Monthly Monthly/ Rarely	Monthly Rarely ☆	Monthly/ Rarely Rarely
20) Tries to help child improve their speech production	Low High	Daily Daily	Daily Daily	Daily Daily	Daily Daily
21) Corrects child's language errors	Low High	Daily Daily	Daily Daily	Daily Daily	Daily Daily
22) Teaches child new words	Low High	Daily Daily	Daily Daily	Daily Daily	Daily Daily
23) Explains to child what was said if they didn't understand someone	Low High	Daily Daily	Daily Daily	Daily Daily	Daily Daily
24) Knows what child is working on in school	Low High	Daily Daily	Daily Daily	Daily Daily	Daily Daily
25) Helps child with homework	Low High	Daily Daily	Daily Daily	Daily Daily	Daily Daily
26) Talks with child's teacher about how child is doing	Low High	Weekly Daily/ Weekly	Weekly Weekly	Weekly Weekly	Weekly Weekly

☆= Notable differences between low and high LNT groups

APPENDIX A

Lexical Neighborhood Test (LNT) (Kirk et al., 1995)

Easy Words:

List 1	
Juice	Need
Good	Food
Drive	Dance
Time	Live (/liv/)
Hard	Stand
Gray	Six
Foot	Cold
Orange	Push
Count	Stop
Brown	Girl
Home	Hurt
Old	Cow
Watch	