

# **Evaluation of the Foundations in Speech Perception Software as a Hearing Rehabilitation Tool for Use at Home**

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The effectiveness of the Foundations in Speech Perception (FSP) software program was evaluated when used by children with cochlear implants over a period of 6 months. Participants included 7 children who used FSP daily at home and 7 matched children who did not use the FSP program. The treatment group demonstrated significantly greater growth of scores on 2 of 4 measures following 6 months' experience with FSP. Within group comparison of pre-study versus post-study scores revealed that the mean scores obtained by the treatment group improved significantly on all 4 speech recognition measures while the mean scores obtained by the control group did not. Finally, children who used the FSP program regularly achieved greater growth in scores on average than children who used the program less than 8 days per month. The latter achieved growth in scores similar to the control group. These results combined with parents' positive statements regarding the FSP program suggest that it may be an effective method of providing a home supplement to therapy provided at school and in the clinic.

The viability of home-based computer therapy programs has improved in recent years as the number of families owning home computers has increased. One such program, Foundations in Speech Perception (FSP; Brown, 1994), appears to be a

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valuable tool for strengthening the speech perception skills of children with hearing impairments. Developed by Dr. Carolyn J. Brown, FSP provides training modules to facilitate development of listening skills in children with hearing impairments, including children who use cochlear implants.

FSP is designed to be used in brief sessions of about 15 min on a daily basis. It provides children with many opportunities to practice and rehearse in a supportive learning environment. Exploration of auditory and visual cues is encouraged, and children may request unlimited repetitions of these cues. It is an adaptive program that automatically adjusts the difficulty of the lesson and the amount of visual support provided to the child based on his/her performance. An elaborate recording system permits the child's progress to be monitored without an adult looking over his/her shoulder. A more detailed description of the FSP software program is provided in Appendix A.

Only a few studies have been published in which the performance outcomes of subjects who have utilized home-based computer therapy programs have been evaluated. Gross and Herrmann (1994) described a computer aided rehabilitation program used in Germany after cochlear implant or hearing aid fitting and found that subjects' auditory perception skills improved more rapidly than when traditional rehabilitation methods were used. Karni et al. (1995) suggested that the speed and accuracy of complex motor tasks of patients with aphasia were improved over a period of several weeks when subjects participated in daily practice sessions with a computer based rehabilitation program. Some investigators have found that performance on visual and auditory tasks improved following consistent daily use of computer rehabilitation programs (Ahissar & Hochstein, 1993; Karni & Sagi, 1993; Merzenich et al., 1996). Tallal et al. (1996) found that two independent groups of children with language learning impairments but normal hearing demonstrated improved temporal processing skills after regularly using computer "games" aimed at enhancing auditory perception. Similarly, Merzenich et al. (1996) found that children who utilized specially designed computer games 5 days a week for 20 days demonstrated improvements in their auditory perceptual ability at the end of the study. Like the computer programs used in the studies of Tallal and Merzenich, the FSP utilizes adaptive training strategies.

Currently, almost 50% of homes in the United States have personal computers (Holstein, 1999). This increasing number of home computers makes rehabilitative software programs, such as the FSP, realistic additions to a patient's rehabilitation regimen. Because children with cochlear implants may need more rehabilitation services than public school special education programs can provide (Nevins & Chute, 1996), and because children may live a long distance from implant centers or hospitals that offer private services, home-based therapy may be one way to facilitate long term success with a cochlear implant.

The primary purpose of this study was to evaluate the effectiveness of the FSP

software program when used daily in a home setting. In order to evaluate the amount of speech perception/production improvements that were attributable to use of this program, speech recognition and production measures were administered to two groups of matched pairs of subjects. Members of the treatment group used the FSP program daily in a home setting for a period of 6 months. Members of the control group did not use the FSP program.

## METHODS

### Participants

Participants consisted of 14 children ages 5 to 12 years with bilateral severe to profound sensorineural hearing losses who received a Nucleus Multichannel cochlear implant at the University of Michigan. The pairs of children were matched according to age (within 1 year); age at onset of profound deafness (within 1 year); age at implantation (within 1 year); length of implant use (within 1 year); educational placement and access to speech and hearing therapy based on parent, school, and/or professional report; preoperative aided speech detection thresholds (SDT; dB HL); and speech encoding strategy (MPEAK or SPEAK). Additionally, all subjects were prelingually deaf, as all lost their hearing prior to the age of 1.25 years. Demographic information regarding the subjects may be found in Table 1. All children had typical cognitive abilities as assessed by a certified clinical psychologist.

In order to evaluate the FSP program, one member of each of the matched pairs of children was randomly assigned to one of two groups. Members of the treatment group used the FSP program on a daily basis in their homes for a period of 6 months. Members of the control group did not use the FSP program at home but were tested with the FSP at the beginning and end of the study. There were no significant differences between groups in terms of the matched variables of age, age at onset of profound deafness, age at implantation, length of implant use, and preoperative aided SDT. Three of the pairs were enrolled in schools using a total communication approach that utilized both spoken and signed language. Four of the pairs were enrolled in schools using an oral communication approach that utilized spoken language only. Six pairs utilized the SPEAK processing strategy and one pair utilized the MPEAK strategy.

### Procedures

Speech recognition and speech production measures were administered to all subjects to evaluate the effect that use/non-use of the FSP program had on such skills. Tests were administered by two audiologists and a speech-language pathologist who did not know to which group the child belonged. Additionally, pre-FSP test scores were kept confidential until after post-FSP testing was completed. A battery consisting of four different tests was administered to each subject before and after the 6-month test period. This battery included two closed-

**Table 1**  
Demographic Information for Study Participants

| Group/pair #                   | Age at onset of deafness (months) | Age at activation (years) | Age at beginning of study (years) | Education methodology | Encoding strategy | SDT dB HL | Gender | Expressive Vocabulary standard score |
|--------------------------------|-----------------------------------|---------------------------|-----------------------------------|-----------------------|-------------------|-----------|--------|--------------------------------------|
| <i>The treatment group/FSP</i> |                                   |                           |                                   |                       |                   |           |        |                                      |
| 1                              | 0                                 | 3.6                       | 7.4                               | OC                    | SPEAK             | 95        | Male   | 53                                   |
| 2                              | 0                                 | 7.3                       | 9.5                               | OC                    | SPEAK             | 55        | Male   | 67                                   |
| 3                              | 12                                | 5.1                       | 7.9                               | OC                    | SPEAK             | 35        | Male   | 49                                   |
| 4                              | 0                                 | 9.8                       | 11.7                              | TC                    | SPEAK             | 45        | Female | 81                                   |
| 5                              | 0                                 | 2.5                       | 5.3                               | TC                    | SPEAK             | 85        | Female | 118                                  |
| 6                              | 0                                 | 8.2                       | 8.6                               | OC                    | SPEAK             | 45        | Female | 55                                   |
| 7 <sup>a</sup>                 | 0                                 | 5.4                       | 9.3                               | TC                    | MPEAK             | 45        | Female | 61                                   |
| <i>M</i>                       | 2.0                               | 6.1                       | 8.4                               |                       |                   | 57.9      |        | 69.1                                 |
| <i>SD</i>                      | 4.9                               | 2.8                       | 2.1                               |                       |                   | 22.9      |        | 24.03                                |
| <i>The control group</i>       |                                   |                           |                                   |                       |                   |           |        |                                      |
| 1                              | 0                                 | 4.3                       | 6.9                               | OC                    | SPEAK             | 40        | Male   | 48                                   |
| 2                              | 0                                 | 8.6                       | 10.4                              | OC                    | SPEAK             | 40        | Male   | 41                                   |
| 3                              | 15                                | 5.5                       | 8.0                               | OC                    | SPEAK             | 40        | Male   | 66                                   |
| 4                              | 0                                 | 9.7                       | 12.1                              | TC                    | SPEAK             | 35        | Female | 72                                   |
| 5                              | 0                                 | 2.7                       | 6.2                               | TC                    | SPEAK             | 95        | Female | 93                                   |
| 6                              | 0                                 | 7.6                       | 8.2                               | OC                    | SPEAK             | 40        | Female | 40                                   |
| 7 <sup>a</sup>                 | 10                                | 4.6                       | 7.8                               | TC                    | MPEAK             | 80        | Female | 82                                   |
| <i>M</i>                       | 2.5                               | 6.4                       | 8.6                               |                       |                   | 52.9      |        | 63.14                                |
| <i>SD</i>                      | 6.1                               | 2.7                       | 2.2                               |                       |                   | 24.1      |        | 20.77                                |

*Note.* Children designated as Total Communication (TC) use sign language and speech within their educational program. Children designated as Oral Communication (OC) use speech alone within their educational program. Expressive Vocabulary was measured using the Woodcock-Johnson Picture Vocabulary test (Woodcock & Mather, 1989). Standard Score mean =  $100 \pm 15$ . FSP = Foundations in Speech Perception.

<sup>a</sup>Subject 7 in the FSP group did not meet the minimum compliance criteria. Therefore, results obtained for this participant and the matched control participant were not used in all of the data analyses.

set speech recognition tests: the Minimal Pairs test (Robbins, Renshaw, Miyamoto, Osberger, & Pope, 1988) and the Northwestern University Children's Perception of Speech test (NUChips; Elliott & Katz, 1980); one open-set test: the Phonetically Balanced Kindergarten test (PBK-50; Haskins, 1949); and one speech production measure: a Percentage Consonant Correct (PCC) that was calculated from a single word articulation test, the Arizona Articulation Proficiency Scale (Fudala, 1974) with no model provided, using Computerized Profiling (Long & Fey, 1993).

Stimuli for the speech recognition measures listed above were administered to subjects in a quiet room at a comfortable listening level via live voice in an auditory-only condition while subjects' speech processors were set to their normal everyday setting with the exception of the NUChips test, which was administered using recorded voice presented at 70 dB SPL. Speech production testing was recorded on videotape and transcribed.

### **FSP Procedures**

Four members of the treatment group had home computers that met the requirements for installation and utilization of the FSP program (see Appendix A). The three additional members of the treatment group did not have home computers and were provided with computers for use during the study. All but one of the children in the control group had access to computers in their home at the start of the study. At the beginning of the 6-month test period, a 1-hr instruction session was provided to each member of the treatment group and to his/her parents regarding use of the FSP program at home. Participants were instructed to use the FSP program 15 min each day for a period of 6 months. Each computer was located in the participant's home in a quiet room away from distractions. Parents were encouraged to have their children use the program at the same time each day with specific instructions that the child was to work independently. Observations in the home suggested that all of the parents complied with these instructions.

Monthly reports generated by FSP software were obtained to monitor progress and compliance. Typically, parents sent copies of the learning strategy report (see Appendix B), which indicated dates of use and progress through the program. Compliance criteria included (a) no more than three consecutive weeks of non-use and (b) a minimum of 15 hr of FSP use during the 6-month test period, or approximately 10 days per month on average. All participants continued to receive their regularly scheduled school and private speech and language therapy, auditory training, and special education services while they were enrolled in the study.

Upon completion of the study, parents of the children in the Treatment group were asked to complete an anonymous questionnaire regarding their child's use of the FSP program. The results of the questionnaire were used to elicit more information on their experience with the FSP software. All 14 children who participated in the study (including the non-compliant user) were given the FSP software as part of the compensation for their participation.

### Data Analyses

A repeated-measures analysis of variance (ANOVA) was used to determine if the change in speech recognition and speech production scores from pre- to post-treatment obtained by the two groups of subjects differed significantly. Additionally, a multivariate analysis of variance (MANOVA) was performed to evaluate changes in scores that occurred between each group over the 6-month time frame of the study for each of the measures. Finally, an ANOVA was used to examine the effect of frequency of use on outcomes.

### RESULTS

The scores obtained by the individual subjects on the various speech percep-

**Table 2**  
Scores Obtained by Individual Participants

| Group                      | Pair #         | NUChips<br>% of 50 |      | MINPRS<br>% of 80 |      | PBK-50<br>% of 50 |      | PCC<br>% |      |
|----------------------------|----------------|--------------------|------|-------------------|------|-------------------|------|----------|------|
|                            |                | pre                | post | pre               | post | pre               | post | pre      | post |
| <i>The treatment group</i> |                |                    |      |                   |      |                   |      |          |      |
| FSP                        | 1              | 74                 | 82   | 89                | 90   | 42                | 48   | 42       | 53   |
| FSP                        | 2              | 56                 | 82   | 89                | 99   | 34                | 36   | 43       | 48   |
| FSP                        | 3              | 62                 | 70   | 91                | 94   | 52                | 66   | 68       | 75   |
| FSP                        | 4              | 30                 | 42   | 70                | 76   | 0                 | 2    | 50       | 71   |
| FSP                        | 5              | 60                 | 62   | 79                | 90   | 48                | 70   | 63       | 92   |
| FSP                        | 6              | 34                 | 50   | 68                | 78   | 0                 | 12   | 31       | 44   |
| FSP                        | 7 <sup>a</sup> | 40                 | 22   | 78                | 68   | 0                 | 2    | 22       | 35   |
| <i>M</i>                   |                | 52.7               | 64.7 | 81                | 87.8 | 29.3              | 39.0 | 49.4     | 63.8 |
| <i>SD</i>                  |                | 17.1               | 16.5 | 10.2              | 9.4  | 23.5              | 26.8 | 14.0     | 18.6 |
| <i>The control group</i>   |                |                    |      |                   |      |                   |      |          |      |
| Control                    | 1              | 40                 | 26   | 49                | 64   | 4                 | 6    | 37       | 34   |
| Control                    | 2              | 80                 | 64   | 81                | 84   | 56                | 36   | 72       | 81   |
| Control                    | 3              | 70                 | 58   | 94                | 91   | 40                | 38   | 70       | 71   |
| Control                    | 4              | 92                 | 63   | 32                | 50   | 69                | 60   | 48       | 47   |
| Control                    | 5              | 38                 | 40   | 73                | 71   | 8                 | 20   | 45       | 55   |
| Control                    | 6              | 36                 | 36   | 60                | 80   | 0                 | 4    | 21       | 31   |
| Control                    | 7 <sup>a</sup> | 46                 | 42   | 85                | 75   | 16                | 18   | 29       | 44   |
| <i>M</i>                   |                | 49.3               | 45.7 | 71.2              | 75.0 | 18.0              | 17.3 | 49.0     | 53.3 |
| <i>SD</i>                  |                | 20.3               | 14.3 | 15.7              | 12.0 | 24.0              | 16.7 | 19.4     | 20.1 |

*Note.* NUChips = Northwestern University Children's Perception of Speech test; MINPRS = Minimal Pairs test; PBK50 = Phonetically Balanced Kindergarten test; PCC = Percentage Consonant Correct; FSP = Foundations in Speece Perception.

<sup>a</sup>Subject 7 in the FSP group did not meet the minimum compliance criteria. Therefore, results obtained for this participant and the matched control participant were not used in all of the data analyses.

tion/production measures are displayed in Table 2. All but one of the children in the Treatment group met the compliance criteria. A second child (Child 4) also used the program irregularly but met the compliance criteria set at the beginning of the study. Nevertheless, data for all of the children were included in the analyses.

Between-group analyses were performed to determine if differences noted between pre- and post-study scores were likely attributable to use of the FSP program. Pre-treatment scores were subtracted from post-treatment scores to obtain individual difference scores. This helped to control for differences in pre-treatment scores between participants. Results are displayed in Figure 1. The control group demonstrated positive mean difference scores, indicating improved skills, on two of the four measures. A negative mean difference score was obtained on the NUChips test and on the PBK-50 test. The treatment group demonstrated positive mean difference scores on all four measures. A repeated-measures ANOVA was used to calculate between group differences for all seven pairs on all four measures. Results revealed significant main effects for differences between groups,  $F(1,12) = 7.97, p < .05$ , and measures,  $F(3, 36) = 3.65, p < .05$ . Interactions were not significant.

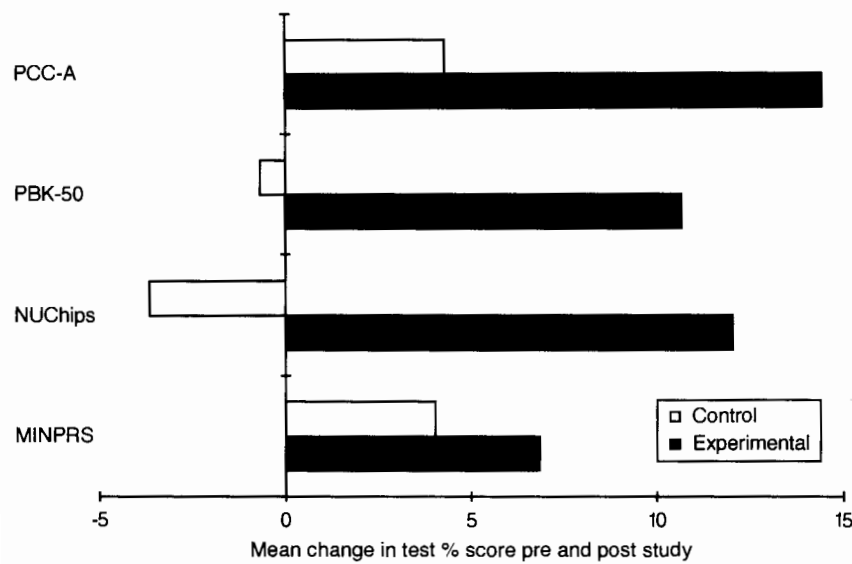


Figure 1. Mean group difference scores obtained by subtracting scores obtained at the beginning of the study from scores obtained at the end of the study. Positive scores indicate improvement on the test while a negative score indicates a decline in score. PCC is the speech production score.

The following are speech perception tests: Phonetically Balanced Kindergarten test (PBK-50), Northwestern University Children's Perception of Speech test (NUChips) and the Minimal Pairs test (MINPRS).

MANOVA was used to compare the mean difference scores obtained by each group for each measure and revealed that the scores obtained by the treatment group were significantly greater than the scores obtained by the control group on two of the four measures, NUChips,  $F(1, 12) = 7.63, p < .05$ , and PBK-50,  $F(1, 12) = 4.35, p = .05$ , with PCC approaching significance,  $F(1, 12) = 4.17, p = .06$ . Differences between the two groups were not statistically significant for the measure MINPRS,  $F(1, 12) = .074, p = .79$ . In summary, children in the treatment group achieved higher scores overall on the measures than did children in the control group.

### The Effect of Frequency of Use on Outcomes

ANOVA was used to examine the effect of frequency of use on outcomes. The individual difference scores were added together to create an outcome difference score. Participants were placed into one of three groups according to the frequency with which they used the FSP program. The first group included children who used the FSP program at least 8 days per month on average. The second group used the FSP program less than 8 days per month. The third group included the children in the control group. There were significant differences between the groups,  $F(1, 12) = 8.86, p < .01$ . Tukey HSD post hoc analysis indicated that there were significant differences between the frequent users and both the infrequent user and control groups (see Table 3). There were not significant

**Table 3**  
Results of ANOVA and Post Hoc Analysis Examining the Effect of Frequency of FSP Use on Outcome Difference Scores

|                | Sum of squares | df | M square | F      |
|----------------|----------------|----|----------|--------|
| Between groups | 5973.82        | 2  | 2986.91  | 8.86** |
| Within groups  | 3706.61        | 11 | 336.97   |        |
| Total          | 9680.43        | 13 |          |        |

| Tukey HSD Post Hoc    |                       |                      |       |
|-----------------------|-----------------------|----------------------|-------|
| (I) group             | (J) group             | M difference (I - J) | SE    |
| Used FSP frequently   | Used FSP infrequently | 45.80*               | 14.99 |
| Used FSP frequently   | Control               | 40.17*               | 10.60 |
| Used FSP infrequently | Control               | -5.63                | 14.99 |

Note. FSP = Foundations in Speech Perception.

\* $p < .01$ . \*\* $p < .01$ .



differences between the infrequent user and control groups. In other words, children who used the FSP program at least 8 days per month on average demonstrated greater progress than children who used the FSP program less than 8 days or more per month. Furthermore, the infrequent users demonstrated progress that was similar to the control group.

**Responses to the Questionnaire**

A questionnaire was provided to the parents of children in the FSP group in order to gain a better understanding of their opinion of the software. Questionnaires were completed and returned anonymously. The results are summarized in

**Table 4**  
Results of Parent Questionnaire

| Question  | Strongly agree               | Agree | Sometimes agree              | Disagree/strongly disagree   |
|---|------------------------------|-------|------------------------------|------------------------------|
| I think FSP is easy to use  | 5                            | 1     | 1                            | 0                            |
| My child thinks FSP is easy to use                                      | 4                            | 2     | 1                            | 0                            |
| My child's listening skills have improved since he/she began using FSP  | 4                            | 3     | 0                            | 0                            |
| My child's speech skills have improved since he/she began using FSP     | 2                            | 5     | 0                            | 0                            |
| My child's vocabulary skills have improved since he/she began using FSP | 4                            | 3     | 0                            | 0                            |
| I would recommend FSP to another family                                 | 3                            | 3     | 0                            | 0                            |
| I would recommend to my child's school                                  | 3                            | 3     | 0                            | 0                            |
| <b>My child uses FSP</b>  | <b>6 to 7 times per week</b> |       | <b>3 to 5 times per week</b> | <b>0 to 2 times per week</b> |
|   | 5                            |       | 2                            | 0                            |
| <b>My child uses FSP</b>  | <b>Independently</b>         |       | <b>When I remind him/her</b> | <b>Only after I insist</b>   |
|   | 2                            |       | 5                            | 0                            |

*Note.* A total of 7 of 7 FSP group parents completed the survey, including the parent of the non-compliant participant. FSP = Foundations in Speech Perception.

Table 4. In general, parents' responses supported the participants' test score results: parents were pleased with the FSP software's ease of use; they would recommend it to a friend or school; and they felt it improved their child's listening skills, speech skills, and vocabulary skills. When asked what they liked *most* about FSP, the parents of two children responded that they found it very easy to use. When asked what they liked *least* about FSP three parents left the space blank. One parent responded: "There is no practice for building sentences, no questions designed for the child to answer, for example, who, what, when, where, why regarding characters in stories." The remaining parents responded, "Nothing."

### DISCUSSION

Our results indicated that use of the FSP program by the children in this study facilitated improved speech perception and speech production skills over a 6-month period. This was demonstrated by improvements on selected speech recognition and speech production measures following 6 months of dedicated use of the FSP program. Children who used the FSP regularly at home demonstrated greater gains on measures of speech recognition and speech production than their matched peers who did not use the program at home. Furthermore, children who did not use the FSP program at least 8 days per month, although they had access to the program and a computer, exhibited progress that was similar to the control group. Thus the presence of the computer in the home and participation in the experimental group alone did not appear to account for the improvement in scores observed. Finally, parents responded positively to the FSP program, stating that they felt it improved their child's listening, speech, and vocabulary skills and was easy to use.

Results obtained by members of the control group appeared to be typical of what has been observed with children who have cochlear implants (e.g., Meyer, Svirsky, Kirk, & Miyamoto, 1998). Over a 6-month period of time, gains in speech perception and speech production skills are typically modest. The results obtained by children who used the FSP program regularly may have exceeded those typically obtained by children with cochlear implants.

Our results indicate that children receive the greatest amount of benefit from the FSP program if they use it frequently. It is interesting to note that the participants who did not use the program at least 8 days per month did not perform as well as children who used the program at least 8 days per month. Furthermore, the children's use of the FSP program was closely monitored and tracked by a professional during the 6-month treatment period of this study. This may have positively affected the study outcome and suggests that close professional supervision may be required to duplicate these results. Additionally, as is true for any intervention study, the results should be interpreted cautiously because they may have been the result of unmeasured variables such as parent involvement or child

motivation. Furthermore, it is not clear that these improvements were sustained after the end of the study. Additional research is needed.

The results of this study support the view that many professionals in our field intuitively feel: that in order to optimize performance with a sensory device, particularly in children, rehabilitation efforts should be supplemented by some form of home therapy. The FSP appears to be ideal for such supplementation, as it is easy and fun to use and provides therapy that may positively influence a child's progression in his/her speech perception and speech production skills.

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## APPENDIX A

### *DESCRIPTION OF SOFTWARE*

Foundations in Speech Perception, designed to run on either Windows or Macintosh computers, is composed of four integrated programs: Administration, Teacher, Reports, and Student. The Administration and Teacher programs provide set-up and security. The Report program is used to track children's progress, providing both overview and detailed daily information. Information regarding the child's activities, correct and incorrect responses, and frequency and length of use are recorded automatically while the child uses the program and retrieved later using one of several report formats.

The Student program is comprised of five separate components: Lessons, Listen to Stories, Tell Stories, Alphabet activity, and Painting. Because the program is designed to be child-centered and child-driven, the child independently inserts a preformatted Key disk, used to identify him or her to the computer. The computer then confirms the child's name and exhibits a screen graphically presenting the five options while providing spoken directions.

The Lessons option consists of over 1200 individual lessons, targeting a wide variety of auditory and reading skills with a vocabulary of approximately 1800 words. The lessons are implemented through two levels of listening activities using a closed set task. The Listen One activities target auditory discrimination abilities and vocabulary development. Listen Two activities are designed to build the relationship between sounds and written text. Each lesson is introduced with a practice task that allows children to explore sentences, words, syllables, letters, or sounds before proceeding to the matching task. It is the matching task upon which the child's progress is measured. Progression through the lessons depends on each child's success. If a lesson proves too difficult, the program automatically provides more auditory and visual support and moves the child to an easier level at which she or he experiences success.

Listen to Stories and Tell Stories activities are designed to enable children to experience the link between oral and written language. Twenty-four stories, developed to reflect the interests of diverse populations, combine primary vocabulary with more challenging text. Children can listen to a story, record the story, and then play it back. Coloring books portraying the stories are provided with the software to encourage carryover of developing skills.

The Painting component may be provided as an activity choice for the child and/or reinforcement within the lessons. For this study, Painting was precluded as a freestanding activity, and the default frequency for reinforcement was used. The availability and frequency of the Painting activity (i.e., how many lessons the child must complete before being rewarded) is set using the Teacher program.

The Alphabet activity is very similar to the Lessons activity, but focuses on teaching either letter sounds or letter names.

#### **Minimum Computer Requirements**

##### PC Compatible

- Intel or compatible 25 MHz 80486DSX or higher
- MS DOS Version 6.0 or later or Windows Version 3.1 or later
- 8 MB RAM
- 250 MB of available hard drive storage
- CD ROM
- SVGA Video Card
- SVGA Monitor
- Audio device with recording capability and compatible microphone

Parallel and Serial Ports  
 3½" Floppy Drive  
 Mouse

Macintosh

25 MHz 68030 or 20 MHz 68040 Processor or higher  
 Mac OS or Macintosh System 7.1 or higher  
 12 MB RAM  
 230 MB of available hard drive storage  
 CD ROM  
 Minimum 256 color (640 × 480 resolution)  
 13" or 14" color monitor (640 × 480 resolution)  
 Dynamic microphone  
 3½" Floppy Drive  
 Mouse

APPENDIX B

SAMPLE LEARNING STRATEGIES REPORT

Foundations in Speech Perception 3.0  
 Learning Strategies Report - Page: 1 Processed: 11/17/XX

| Activity                           | Date     | Task Time | Exp | Resp (Sec) | Correct% | Exp Cor% |
|------------------------------------|----------|-----------|-----|------------|----------|----------|
| Class: Home                        |          |           |     |            |          |          |
| Group: All                         |          |           |     |            |          |          |
| XXXXXXXXXX (Child's Name)          |          |           |     |            |          |          |
| Plan: GSL_DIFF SENT                |          |           |     |            |          |          |
| Packet: SLDIF-NSENTSEN-1           |          |           |     |            |          |          |
| Sentence v. Sentence - Minimal     |          |           |     |            |          |          |
| Last word, vowel v. vowel, minimal |          |           |     |            |          |          |
| Lesson: SIGN_DIFLV-1               |          |           |     |            |          |          |
| Practice Listen1                   | 10/28/XX | 11:53     | 22  |            |          |          |
| Listen1 3                          | 10/28/XX | 1:44      | 10  | 13.80      | 50       | 25       |
| Listen1 4                          | 10/28/XX | 2:35      | 3   | 9.26       | 62       | 12       |
| Lesson: SIGN_DIFLV-2               |          |           |     |            |          |          |
| Practice Listen1                   | 10/30/XX | 8:26      | 23  |            |          |          |
| Listen1 3                          | 10/30/XX | 1:00      | 2   | 7.27       | 50       | 50       |
| Listen1 4                          | 10/30/XX | 2:07      | 2   | 5.38       | 62       | 12       |
| Lesson: SIGN_DIFLV-3               |          |           |     |            |          |          |
| Practice Listen1                   | 11/1/XX  | 4:02      | 22  |            |          |          |
| Listen1 3                          | 11/1/XX  | 1:07      | 2   | 8.60       | 75       | 25       |
| Listen1 4                          | 11/1/XX  | 1:37      | 0   | 4.59       | 100      | 0        |

Explanation of Table

The heading provides information about the child's status in the program and which Plan and Packet the child is following. The *Activity* column describes the specific lesson the child accomplished. *Date* is the date upon which the child accomplished the lesson. *Task Time* represents the time the child spent on the task in minutes and seconds. *Exp* is the number of exposures the child had to the targets. *Resp (Sec)* is the mean response time to the targets overall in seconds. *Correct%* represents the percent of the items correct for which the child did not request additional cues from the computer. *Exp Cor%* represents the percent correct after cues. Adding *Correct%* and *Exp Cor%* together provides the total correct. Please note that this is an actual Learning Strategies Report so the child's name and the dates have been deleted to protect confidentiality.