Chapter Eight

RESULTS: EXPERIMENTAL DATA

8.1　Introduction

This chapter presents the data collected from the testing of the children participating in the study; these were the older students in the four JACs in the ACT and the younger students in the class in the special school in NSW. As noted in Chapter Four (4.4.1), a pretest-posttest-postposttest approach was used to measure the effects of two treatments, namely a music program and a story-telling program, on the students before and after intervention. The purpose of the postposttest was to investigate retained effects of the intervention programs, and effects not apparent at the posttests. The listening skills of 43 students were assessed (pretest) with the test battery (see Chapter Three, Table 3.1), during the second-to-last school week of Term One in March, 1989, in the ACT and during the second week of Term Two in April, 1989, in NSW. All of the children in the ACT and NSW were administered the posttests in Term Three in September; the second-to-last week of the intervention period, Week 22. The postposttests took place in Term Four in November, seven weeks after the conclusion of the intervention period in the ACT, and nine weeks after the conclusion of the intervention period in NSW.

At the time of the postposttests in November, a total of 37 students were administered the test battery. The analysis of the test results was thus based on a student population of 37; 29 students in the ACT and 8 students in NSW. Reasons for the decrease in student numbers were discussed in Chapter Five. The

seven measures assembled to test the student's listening skills were described in detail in Chapter Three. The test battery, remained the same for each of the three testing periods.

The data in this chapter will be presented through two sets of figures; those illustrating the mean performance scores for each of the seven measures and those derived from an analysis of variance.

8.2 Data analysis

Data, collected from the pretests, posttests and postposttests were analysed using a two-way analysis of variance. One JAC in the ACT acted as a control group and the special class in NSW acted as a contrast group. A univariate analysis of variance was the recommended and adopted procedure used to address the hypothesis, specifically, that participation in music activities develops children's listening skills. The analysis was designed to assess whether the treatment of a music program, a story-telling program or the combination of both a music program and a story-telling program, led to the development of listening skills in children.

8.3 Results

8.3.1 Mean performance scores for each of the seven measures

Data in Figure 8.1(a-g) show the mean performance scores (MPS) obtained in the seven measures for the pretest, posttest, and postposttest. The standard error of difference between the means (SEM) has not been included in these figures for clarity of presentation. Data containing the SEM for each test are appended (see Appendix F).
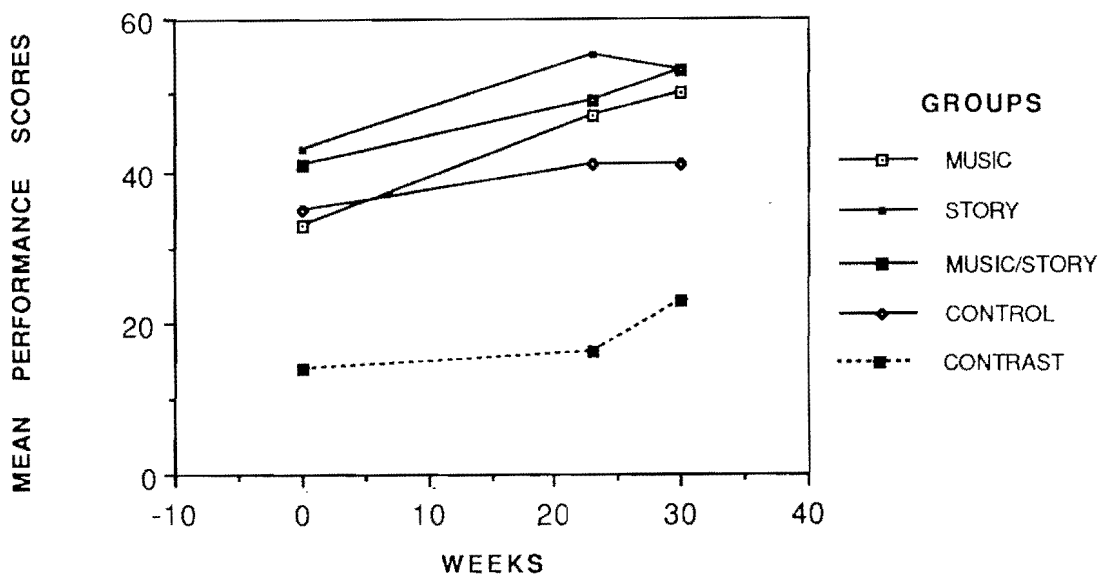
Figure 8.1 (a-g). Mean Performance Scores for Measures
Tested for Music, Story, Music/Story, Control and
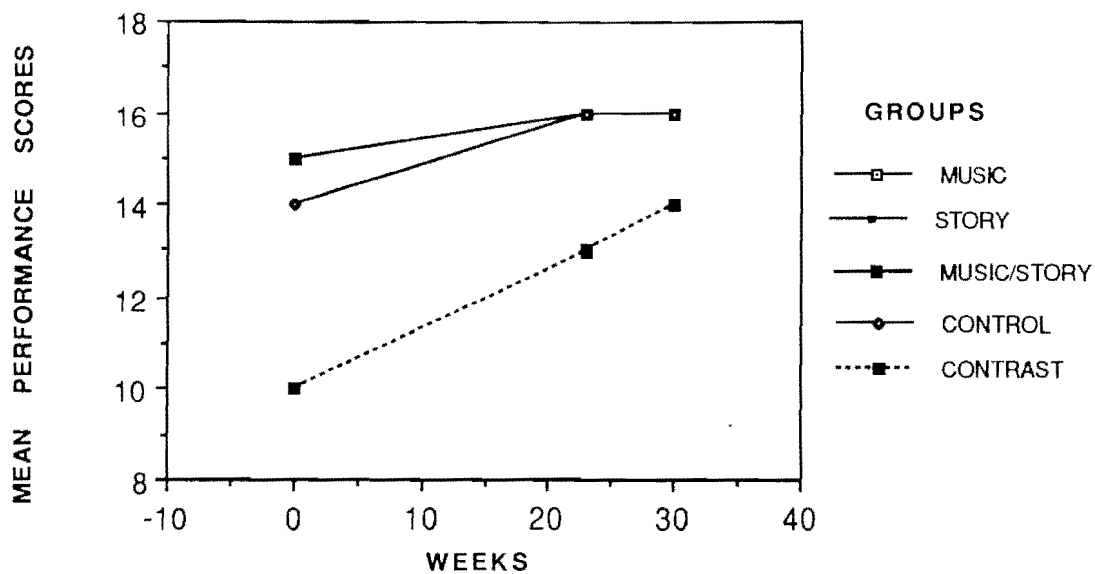Contrast Groups.

a. PPVT-R

b. LAC-R
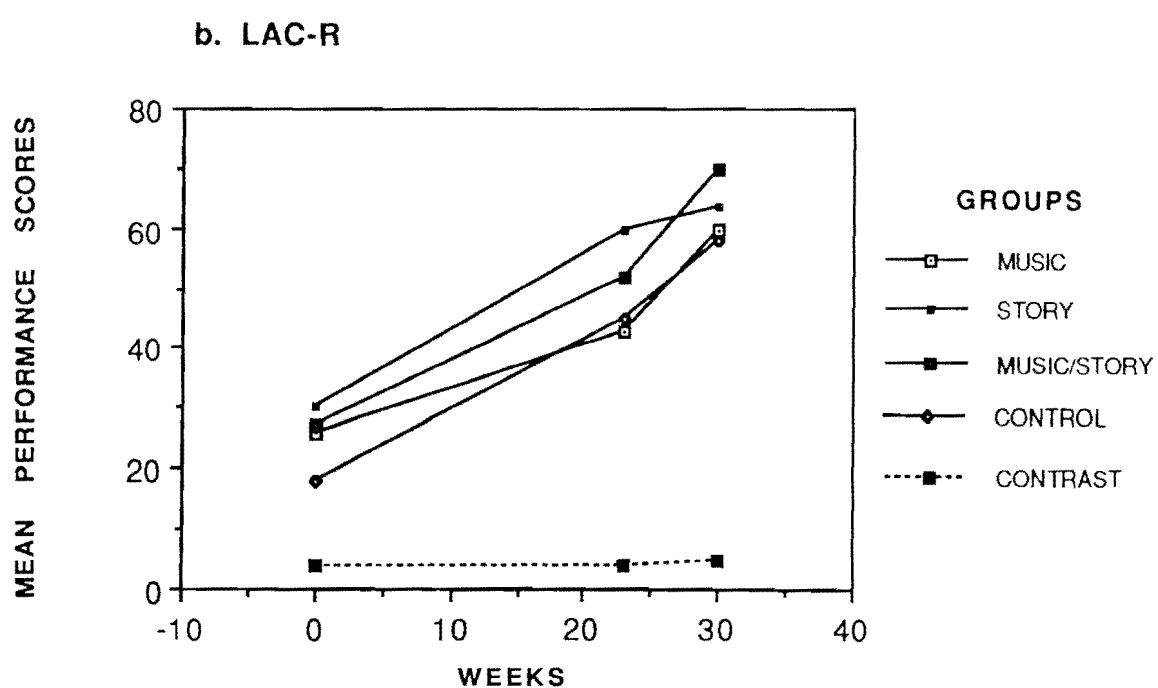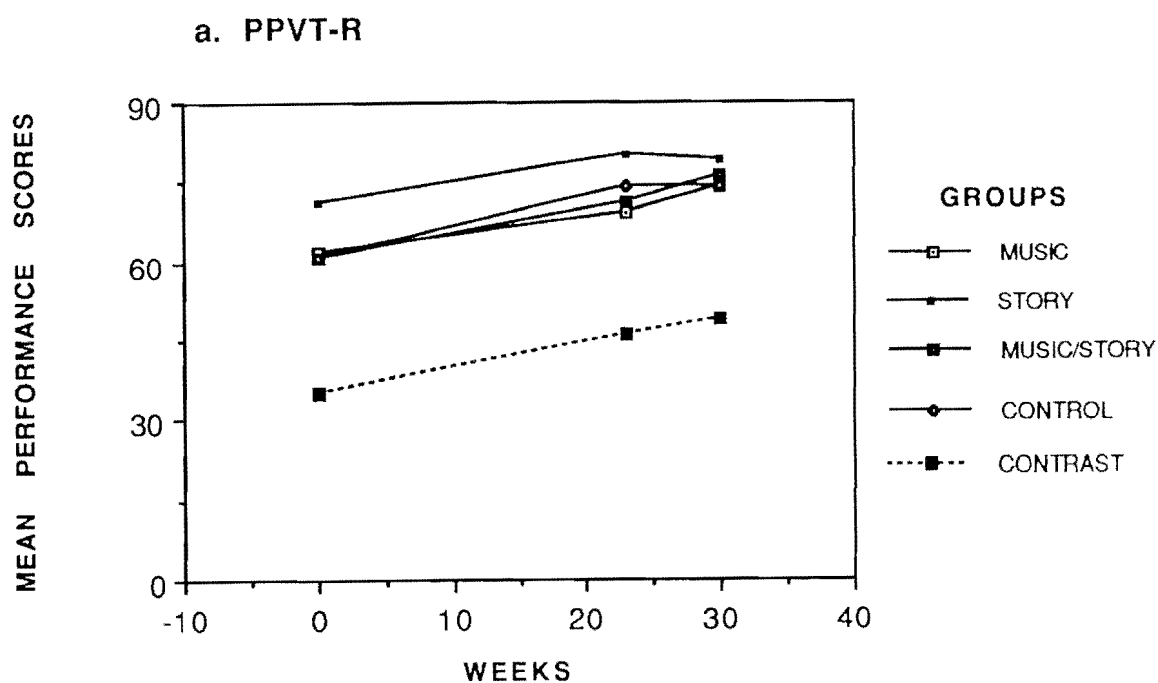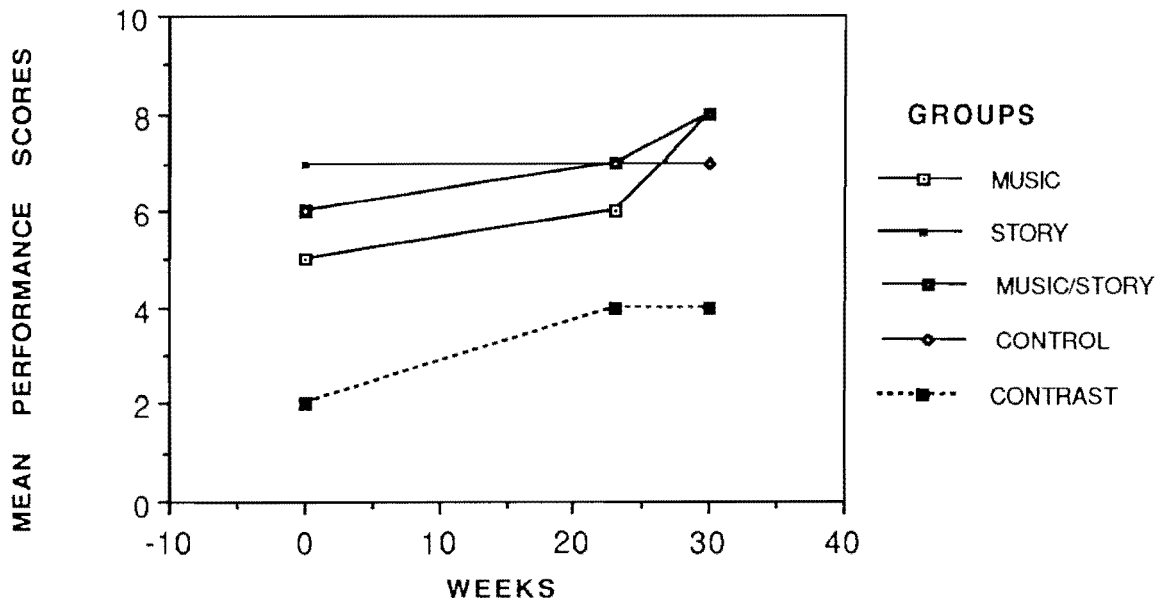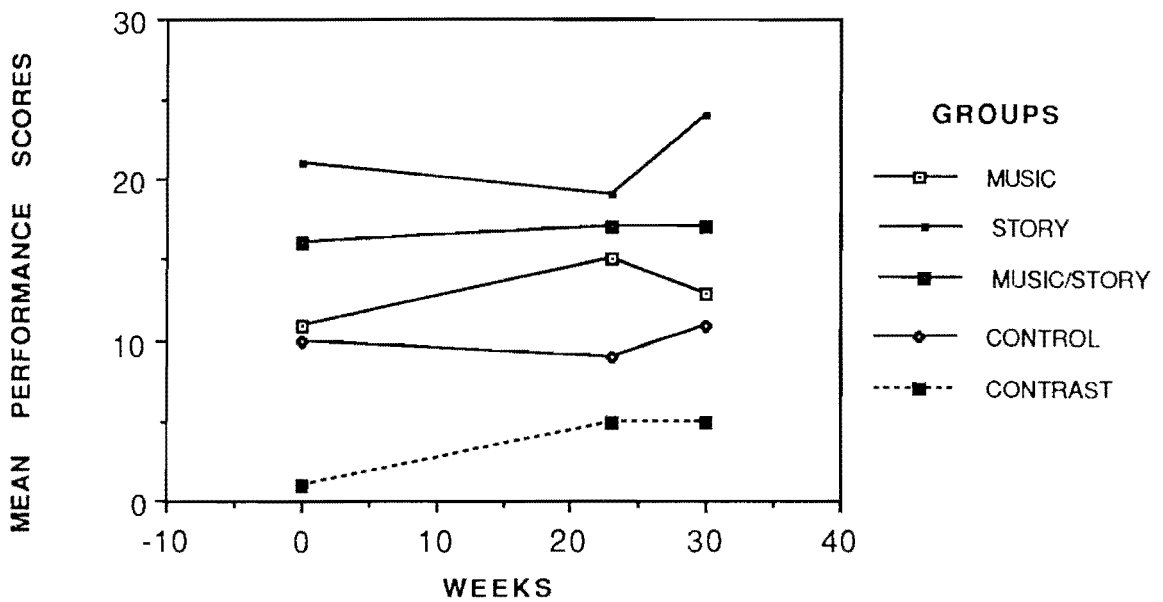
c. Rhyme Test
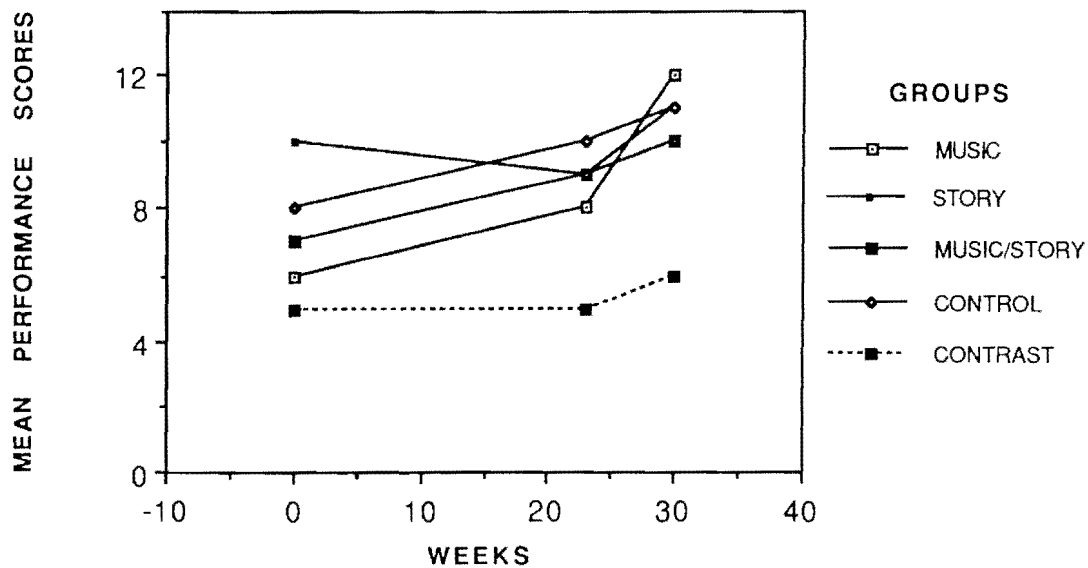
d. Token Test

e. BLCST

f. ARSCT

g. Maths Test

Note. The pretest, posttest and postposttests were conducted at 0, 22 and 30 weeks, respectively.

The MPS for the contrast group in NSW were consistently the lowest of all the scores in each of the seven measures. A general trend evident in four of the measures for this group (PPVT-R, BLCST, ARSCT, Maths Test), appeared to be an increase in the MPS from the pretest to the posttest. A further increase in this group, occurred between the posttest and postposttest for the PPVT-R and BLSCT, while the MPS for the ARSCT and Maths Test remained the same. The other three measures (LAC-R, Rhyme Test, Token Test), showed little or no increase in the MPS between the pretest and posttest but an increase between the posttest and postposttest.

The figures for each of the seven measures now will be discussed with reference to the music only, story only, music/story, and control groups in the ACT. Individual scores gained in each of the measures pertaining to the groups, are appended
(see Appendix F).

Figure 8.1 a (PPVT-R). The MPS for the pretest were highest for the story group and increased from the pretest to the posttest for each of the four groups. Analysis of the scores of each child revealed that only one score decreased for the posttest; a child in the music only group was experiencing reading difficulties. The MPS of the groups experiencing music increased further at the postposttest. Analysis of the scores of each child revealed that each had increased for the music only group, and that the scores of all but one child (problems with ESL) had increased for the music/story group; one child remained the same and one child had an increased score of seven points above that of any other child in the four groups. In the story only and control groups half the number of children (3) in each group had decreased scores at the postposttest.

Raw scores were used for the PPVT-R on the basis that the children in the four ACT groups were of a similar age, as were the younger children in the NSW group; the same test form (Form M, see Chapter Three, 3.2.2.1) also was used for all five groups.

Figure 8.1 b (LAC-R). The MPS for the pretest were lowest for the control group. All individual scores, but for one child (experiencing problems with behaviour) in the control group, improved at the posttest with the music only group scoring slightly below the average of the four groups. In each group at the postposttest there were one or two children with decreased scores. One child from each of the music only, the music/story, and the control groups gained the maximum score possible (100) at the postposttest.

Figure 8.1 c (Rhyme Test). The MPS for the pretest were highest for the story only group; one child scored the maximum possible (15). The scores of four children in the story only group, including the child who scored the maximum possible, decreased at the posttest. One child from both the music only and the music/story groups scored the maximum possible at the posttest, with the child in the music only group maintaining this result at the postposttest. One child from the story only group also scored the maximum possible at the postposttest.

Figure 8.1 d (Token Test). The MPS for the pretest showed that the music only group scored lower than the other three groups. The scores of all the children in each of the four groups improved at the posttest with one child scoring the maximum possible (61) in the music/story group. At the postposttest one child in the music/story

group and three children in the story only group scored the maximum possible.

Figure 8.1 e (BLCST). The MPS for the pretest were lowest for the control group. At least half of the children in each of the other three groups scored the maximum possible (16) at the pretest compared to only one child in the control group. At the posttest two children in the music only group and one child in the control group had decreased scores. All the children in the four groups had maximum possible scores at the postposttest.

Figure 8.1 f (ARSCT). The MPS for the pretest were lowest for the music only group and highest for the story only group. One child in each of the four groups scored the maximum possible (8) at the pretest. The MPS for the posttest continued to remain the lowest for the music only group. A number of children in each group, except the control group, scored the maximum possible at the posttest. At the postposttest, all, apart from two children in the music only and story only groups, one child in the music/story group, and three children in the control group had maximum possible scores.

Figure 8.1 g (Maths Test). The MPS for the pretest were the highest for the story only group and remained the highest for the posttest and the postposttest. The decrease in the MPS for the story only group at the posttest was due to one child with the highest score at the pretest having a decreased score at the posttest; the score had increased again at the postposttest. The score of one other child in the story only group also increased considerably at the postposttest. Individual scores also affected the MPS for the music only and control groups, at the post and postposttests. The

maximum possible score (113) was not reached by any child in the four groups.

Some general comments now can be made about the data presented in Figure 8.1 (a-g). For example, as mentioned above, the MPS scores for the contrast group in NSW were lower than the MPS scores for the music only, story only, music/story, and control groups in the ACT in each of the seven measures. This could be attributed to the younger age of the children in the contrast group. The gain in MPS for this group, from the pretest to the posttest for the PPVT-R, BLCST, ARSCT and Maths Test, suggest that the children, who had not attended school prior to 1989 (see Chapter Four, 4.2.2), had settled into a class routine and, at the posttest, were grasping receptive language, sound and mathematical concepts. This apparent development continued for the PPVT-R and the BLCST but had evidently plateaued for the ARSCT and the Maths Test at the postposttest. The language skills of phonological processing and listening comprehension for this group appeared to take longer to develop as little, or no increase in the MPS was evident until the postposttest of the LAC-R, Rhyme Test and Token Test.

Other overall comments about data related to the music only, story only, music/story, and control groups, is that in general, apart from the Maths Test, group scores were at least maintained or, in most cases, increased between the pre and posttest. The main exceptions were the decreased MPS for the story only group in the posttest of the Rhyme Test, and the postposttest of the PPVT-R and Token Test. The depressed MPS for the Rhyme-posttest could be attributed to the decreased scores of four children including one child with the maximum possible score (15) at the pretest. In the

postposttest for the PPVT-R, the scores of three children decreased; one child was experiencing difficulties due to ESL, and another child (case study B2), was recorded as "off-task" for the test. The MPS for the Token Test would have been depressed by three children reaching the maximum possible score (61) at the postposttest.

The most consistent and most marked changes in MPS for the four groups were in the LAC-R with an increase in the pretest, posttest and postposttest scores for each group; maximum possible scores (100) were gained by a student from each of the music only, music/story and control groups at the postposttest. Although high individual scores were recorded in the BLCST and the ARSCT, these were diminished in meaning due to the ceiling effect, that is, many of the children had gained the maximum possible score (16) in the BLSCT at the pretest and in the ARSCT (8) at the posttest. The MPS for the Maths Test would appear to indicate that, apart from a few individual scores, a stronger connection exists between the listening skill measures than between these measures and a measure of mathematical skills (see Chapter Three, 3.2).

8.3.2 Analysis of variance

The variance ratios calculated from the two-way analysis of variance for each of the seven measures are shown in Table 8.1. Those values equal to or greater than 4.17 (selected from the table of the F distribution P=0.05) reflect an effect that is statistically significant.

Measures administered to the students in the music only, story only, music/story, and control groups showing statistical significance ($p < .05$) were observed with the Token Test, the Rhyme Test and the PPVT-R. Each of these measures assessed different

aspects of student's listening (see Chapter 3, 3.2.2). As shown in Table 8.1, three variance ratios are >4.17, the critical value for .05 statistical significance, for the postpost-posttest period for the PPVT-R, the postpost-pretest period for the Rhyme Test, and the postpost-pretest period for the Token Test for the music only group. The Rhyme Test shows statistical significance for the postpost-pretest period and for the postpost-posttest period for the story only group, and the Token Test for the post-pretest period for the music/story group.

The LAC-R, Rhyme Test, BLCT, and Maths Test indicated statistical significance between the results of the ACT and NSW groups; these will be referred to later.

Table 8.1

Variance Ratios Calculated from the Appropriate Analysis of Variance

Measure	ACT/NSW[a]	Music[b]	Story[c]	Music/Story[d]
PPVT-R				
Post-Pre	0.23	1.55	0.01	2.69
Postpost-Pre	0.21	1.16	0.00	2.56
Postpost-Post	0.00	5.85	0.00	0.08
LAC-R				
Post-Pre	16.51	1.33	0.96	0.21
Postpost-Pre	20.19	0.08	0.16	0.91
Postpost-Post	3.01	1.85	0.16	0.52
Rhyme Test				
Post-Pre	1.61	2.21	0.31	1.95
Postpost-Pre	5.89	5.78	5.62	0.01
Postpost-Post	1.91	1.16	4.90	3.47
Token Test				
Post-Pre	1.97	0.49	0.15	4.23
Postpost-Pre	2.05	6.11	0.10	3.17
Postpost-Post	0.17	2.45	0.01	0.19
BLCST				
Post-Pre	21.91	1.18	0.91	1.61
Postpost-Pre	19.34	1.73	1.47	1.08
Postpost-Post	0.27	0.24	0.31	0.22
ARSCT				
Post-Pre	3.82	0.37	0.77	0.02
Postpost-Pre	0.55	2.56	3.06	0.15
Postpost-Post	2.62	1.04	0.81	0.28
Maths Test				
Post-Pre	0.99	0.43	1.43	0.05
Postpost-Pre	5.01	0.04	0.07	1.63
Postpost-Post	0.00	3.05	1.28	0.08

Note. The headings refer to the contrast being tested. [a]A comparison of results from NSW with those of the ACT. [b]A comparison of Music versus No Music means. [c]A comparison of Story versus No Story means. [d]The interaction effect between Music and Story; that is, the music effects in the presence of Story compared to No Story.

Analyses relating to each of the three measures showing statistical significance for the music and story groups, and which addresses the hypothesis that music can have an effect on the development of listening skills such as receptive vocabulary, phonological processing and listening comprehension, are shown in Figures 8.2 to 8.7. The formula used to calculate the 95% confidence intervals from the Analysis of Variance is appended (see Appendix F).

Figure 8.2 shows the mean of the post-pretest for Token Test scores and 95% confidence interval, for the music only, story only, music/story, and control groups.
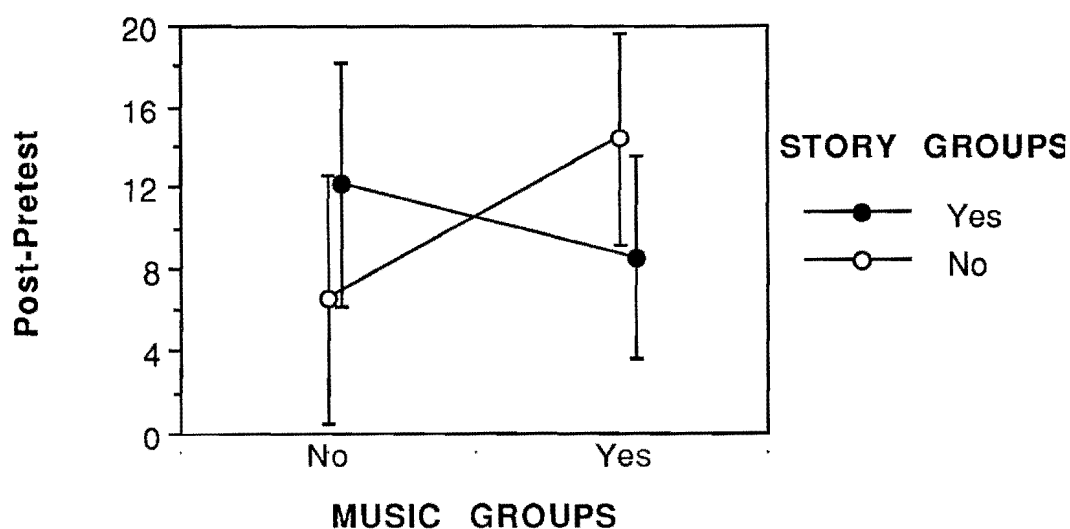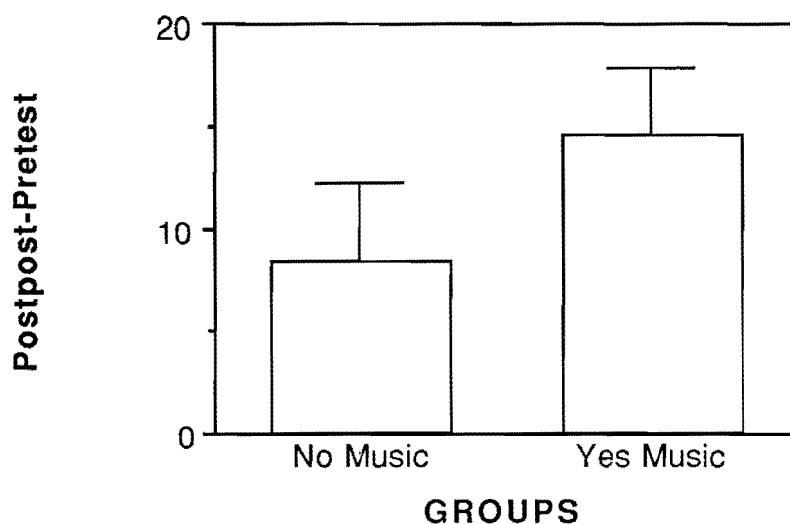

Figure 8.2 Mean of Post-Pretest for the Token Test scores and 95% Confidence Interval for Music, Story, Music/Story and No Music/No Story groups.

The analysis indicates several points relating to the development of listening comprehension skills. The first is that music alone has an enhancing effect; the second is that story alone

likewise has an enhancing effect; and the third is that the combination of music and story does not have an enhancing effect but rather appears to have more of an inhibiting effect. The analysis indicates therefore that an interaction took place between the effects of music and of story. This interaction implies that each of music or of story alone is more effective in enhancing listening comprehension skills. The mean gains on the Token Test for the groups for the post-pretest are appended (see Appendix F, Table 8.2).

The mean of the postpost-pretest for the Token Test scores and 95% confidence interval, are shown for the music and no music groups in Figure 8.3. In this analysis the no music group includes also the story groups.

Figure 8.3 Mean of Postpost-Pretest for Token Test scores and 95% Confidence Interval for Music and No Music groups.

This figure illustrates the overall effect of music. It would appear that the enhancing effect of music seen in Figure 8.2 on the development of listening comprehension skills is sustained into the

postposttest period. The mean gains on the Token Test for the groups for the postpost-pretest are appended (see Appendix F, Table 8.3).

Figure 8.4 shows the mean of the postpost-pretest for the Rhyme Test scores and 95% confidence interval, for the music and no music groups and Figure 8.5 shows the mean and 95% confidence interval, for the same period for the Rhyme Test for the story and no story groups.
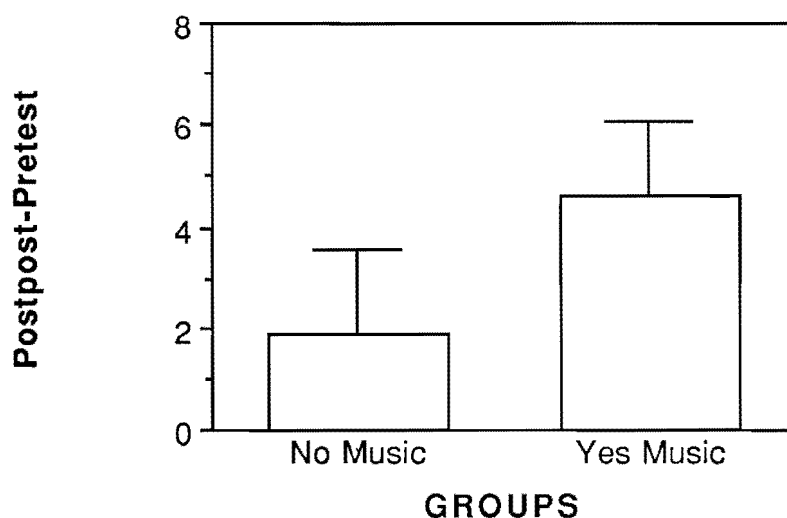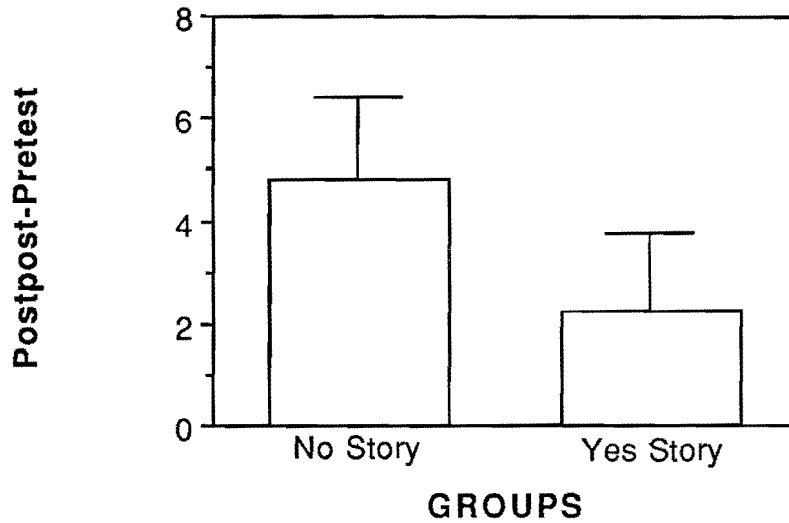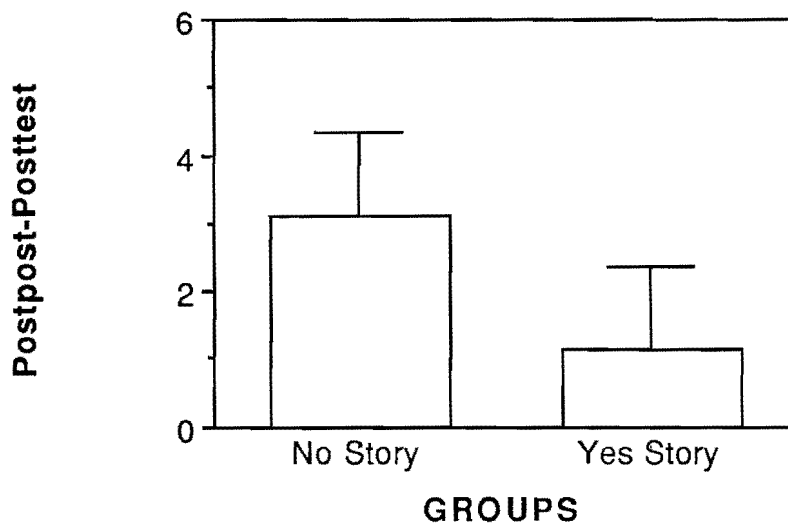

Figure 8.4 Mean of Postpost-Pretest for Rhyme Test scores and 95% Confidence Interval for Music and No Music groups.

The analyses shown in Figures 8.4 and 8.5 suggest that music had more of an effect on the development of phonological processing skills than that of story, and that as shown in Figure 8.5, story appeared to have a negative effect.

Figure 8.5 Mean of Postpost-Pretest for Rhyme Test scores and 95% Confidence Interval for Story and No Story Groups.

Figure 8.6 Mean of Postpost-Posttest for Rhyme Test scores and 95% Confidence Interval for Story and No Story groups.

It would appear from Figure 8.6, which shows the mean of the postpost-posttest for the Rhyme Test and 95% confidence interval, for the story and no story groups, that the phonological processing

skills of the students experiencing story, decreased further during this period.

The mean gains on the Rhyme Test for the groups for the postpost-pretest and the postpost-posttest are appended (see Appendix F, Tables 8.4 & 8.5; Table 8.6).

Figure 8.7 shows the mean of the postpost-posttest for the PPVT-R and 95% confidence interval, for the music and no music groups.
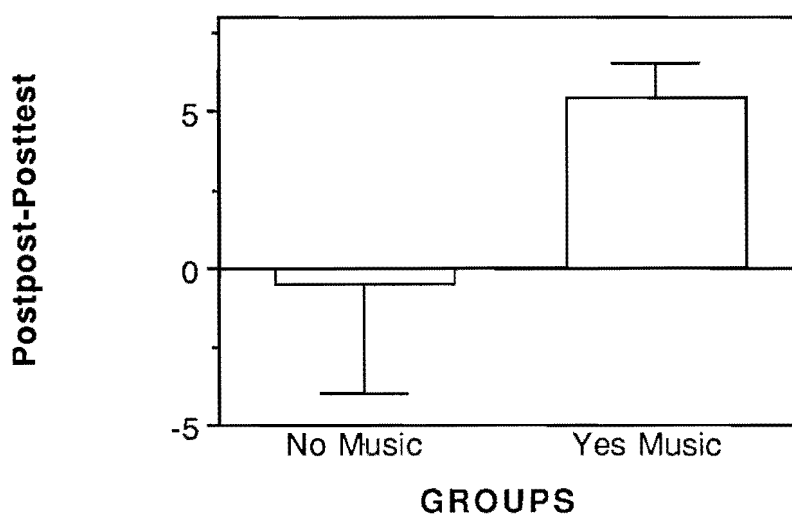
Figure 8.7   Mean of Postpost-Posttest for PPVT-R scores and 95% Confidence Interval for Music and No Music groups.

The analysis suggests that music has an effect on the receptive vocabulary of the students for this period. The mean gains on the PPVT-R for the groups for the postpost-posttest are appended (see Appendix F, Table 8.7).

As mentioned above, four tests (LAC-R, Rhyme Test, BLCST, Maths Test) showed a statistically significant effect (see Table 8.1) when comparing the results of the ACT groups and the NSW group. This occurred mainly between the postpost-pretest and could

reflect further on the fact that the children in NSW were younger, had not previously attended school, were adjusting to a class routine and were learning to co-operate, for instance, in a testing situation. At the pretest for the LAC-R, Token Test, ARSCT, and Maths Test, for example, there was a nil-performance from some children in the NSW group. The MPS scores for the Rhyme Test for the NSW group did not change from the pre to the posttest whereas in the ACT groups two children had maximum possible scores at the posttest. The number of maximum possible scores at the pretest, posttest and postposttest for the BLCST in the ACT groups also would affect the results between the ACT groups and NSW group. A reason as to why a similar effect did not show in the other three measures (PPVT-R, Token Test, ARSCT) could be due to a similar trend in increased scores from the pretest, posttest and postposttests between the ACT groups and the NSW group, although the NSW group had considerably lower scores. As the comparison of results between the ACT groups and the NSW group is not statistically significant in relation to the music and story effects, the contrast group (NSW) will not be referred to in the remaining discussion.

Some general comments now can be made about the data summarised in Figures 8.2 - 8.7. For example, the music and story effects for the Token Test and Rhyme Test were statistically significant for the postpost-pretest. A further story effect is noted for the postpost-posttest of the Rhyme Test and the effect of music is not apparent until the postpost-posttest of the PPVT-R. These findings appear to indicate that a longer period of time is needed for a statistically significant music effect or story effect to show.

8.4   Summary

In this chapter, summaries of the data have been presented showing the mean performance scores for each of the seven measures and results from a two-way analysis of variance. The statistic obtained from the analysis of variance shows a music effect and story effect on the development of different aspects of listening skills, namely receptive vocabulary, phonological processing and listening comprehension as measured by the PPVT-R, Rhyme Test and Token Test. However, the impact of music was stronger than that of story. There appeared to be no evidence of an association between the listening skill measures and the measure of mathematical ability, suggesting that the music, story, and listening activities had little impact on this area of the curriculum. The apparent effect of music, and to a lesser extent of story, on the development of listening skills and indirectly, on the cognitive processing skills of the students will be discussed in the following chapter.