Children's Memory Tested: An Experiment on Preschool Children's Memorization Ability

Singing vs. Talking

We are interested in how children learn and what factors help their memory. We thought that singing might help children remember a list of facts better than just saying them out loud. To test this, we conducted an experiment to test whether children remember better with singing or just speaking. We used a local preschool in town and sampled from the 3-5 year olds who could speak.

Our response variable is the amount of words that the child remembers correctly with and without music. The explanatory variable is the type of instruction they get, with two treatments: speaking, and speaking set to music.

- Question: Are children better able to remember information with or without music?
- Our parameter of interest is Santa Fe Little School in Gainesville, FL.
- Null hypotheses: The music will have no affect on children's ability to remember
  H_0: $\mu_D=0$, where $\mu_D=\mu_1-\mu_2$ (μ_1 = Singing, μ_2 = Speaking)
- Alternative: Music will have a positive affect on children's ability to remember.
  Ha: $\mu_D > 0$ where $\mu_D=\mu_1-\mu_2$

We are going to test children's memory and see if music helps or hinders their ability to remember a list of words. We have a population of 50 3-5 year old children, who can all speak, from a local preschool. We will randomly select a sample of 21 children. We perform both treatments on each child selected to account for lurking variables. We will say a series of 5 animals 3 times in a row and have the child say as many as they can remember. Then we will sing with a familiar song a different series of 5 animals 3 times in a row and the child will recite what he or she remembers. We will repeat this process for each child in the sample, recording the amount of animals they remember correctly for both treatments. Children would receive one sing treatment and one talk treatment, and which one they received first was randomly assigned for each child.

Table of Treatments

Sing 1	**Talk 1**	**Sing 2**	**Talk 2**
Lion	Horse	Horse	Lion
Cat	Owl	Owl	Cat
Dog	Fish	Fish	Dog
Frog	Pig	Pig	Frog
Bear	Duck	Duck	Bear

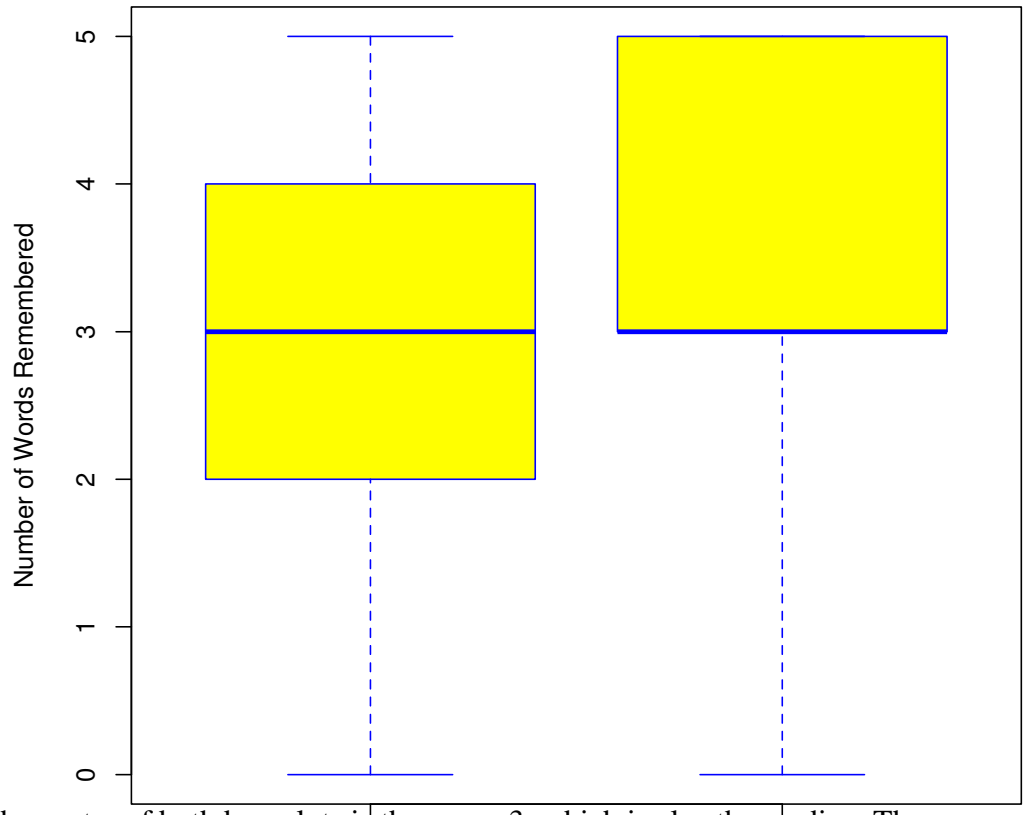
Our method of data collection uses random assignment to assign the children to treatments. The animals were randomly selected from a list of 25 animals to pick which 10 we will use in our study. The children were selected randomly but not by us, they had to be picked by their teacher. In order to carry out random assignment, we alternated treatments starting on a random treatment (talk or sing as the first treatment). The children flipped a fair coin to decide whether they will have sing 1 or sing 2 or talk 1 or talk 2 depending on the alternation for that child.

We eliminated bias by recording the song and speech so it would be the same for each child. We asked each child the same questions and phrased the directions the same way. Then we let each child listen to each recording three times. We tried to make it the exact same for each child by doing it in a similar location and by having the same person record the data versus giving the instructions. We randomized the four treatments so there would be no bias about favoring a specific treatment (saying or speaking first).

Our summary statistics for the differences are:

- Min = -3, Max = 2, Median = 0, Mean = -0.2857, Standard Deviation = 1.149

Box plot of Data. First box = singing. Second box = speaking.

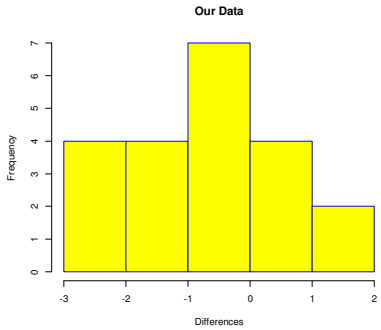


The center of both box plots is the same, 3, which is also the median. The max and min of both are 5 and 0, respectively. These box plots give evidence for our conclusion that there is no difference between singing and speaking.

We chose to do a paired t test for means. We took the difference for each child of the number of correctly remembered animals from singing minus the number of correct animals from talking. We chose to do a matched pairs design in order to eliminate lurking variables that could have arisen because of differences between children. The t test was chosen because we wanted to take the differences between the before and after results of each child.

The conditions for this significance test are met:

- Normal: The histogram is symmetric, bell-shaped with no outliers so we assume that the sample is drawn from a normal or near-normal population



- Random: There was random assignment of treatments, and the children were randomly sampled
- Independence: Our observations are independent from one another.

Inference procedure and results:

- α=0.05
- t = -0.9225
- df = 20
- p-value = 0.3672
- 95 percent confidence interval:
  (-0.9317516, 0.3603230)

Since p-value > α, there is insufficient evidence to reject that there is no difference between the difference of mean number of words that children can remember with and without music. We are 95% confident that the interval from -0.9317516 to 0.3603230 captures the true mean difference of words that children are able to remember with and without music. Since this interval includes zero we can conclude zero is a plausible value, which means we cant reject H_0.

Since our p-value (0.3672) is more than our significance level = .05 we fail to reject H_0: μ_D=0, where μ_D=μ_1- μ_2. We don't have enough evidence to conclude there is a significant difference between singing and talking in children's memory. So to answer our question, in our

population of Little School, children are not better able to remember information with music. We can cause and effect to our population of preschoolers because it is an experiment.

There are limitations found in this experiment, such as ages of the children, which might have affected the results of the treatments. We wanted to block by age but our sample size wasn't large enough to do so. The children presented some errors because we couldn't do the experiment exactly the same since each child needs specific attention and instruction. Also, we had to gather our research on two different days and in two different rooms. We tried to eliminate distractions but there were limited distractions in both locations like toys, books, stickers… that might have influenced data. There were no safety or ethical issues in this study design, but we did ensure that the parents of the children were okay with us including their children in our study.

Our R Script

```
laura.alexia.data <- c(-1,0,0,0,0,2,-3,-3,-2,-1,1,-1,0,0,0,1,-2,-
 1,1,1,2)
hist(laura.alexia.data,main="Our
 Data",xlab="Differences",col="yellow",border="blue")
our.standard.dev <- sd(laura.alexia.data)
# We calculated our sd to be 1.419255
t.test(laura.alexia.data)
singing.data <- c(4,5,2,0,3,2,2,0,3,2,4,2,4,4,5,4,2,3,3,4,3)
saying.data <- c(5,5,2,0,3,0,5,3,5,3,3,3,4,4,5,3,4,4,2,3,5)
boxplot(singing.data,saying.data,main="Singing Vs.
 Speaking",ylab="Number of Words
 Remembered",col="yellow",border="blue")
hist(laura.alexia.data,main="Our
 Data",xlab="Differences",col="yellow",border="blue")
mean(laura.alexia.data)
max(laura.alexia.data)
min(laura.alexia.data)
median(laura.alexia.data)
hist(laura.alexia.data,main="Our

Data",xlab="Differences",col="turquoise",border="blue")
```

One Sample t-test R Results:

data: laura.alexia.data

t = -0.9225, df = 20, p-value = 0.3672

alternative hypothesis: true mean is not equal to 0

95 percent confidence interval:

 -0.9317516 0.3603230

sample estimates:

 mean of x

-0.2857143