Does playing an instrument increase the length of your hand?

Introduction

Hand lengths vary all across the world. In all genders, ethnicities, there are always people with large hands and people with small hands. What factors cause the difference in length of hands? Instrument players tend to stretch their fingers more often for example when playing the piano your fingers must stretch apart to play a chord. In this experiment we are studying whether playing an instrument is a main cause for the difference in hand size by taking measurements from the tip of the left middle finger to the wrist line.

Question

Do people that play instruments have longer hands than people that do not play instruments?

Hypothesis

If we compared the lengths of hands between boys in the 11th grade that do and do not play instruments then the people that play instruments would have longer hands because their fingers are stretched more often.

We chose to limit it to boys to eliminate some chances of error since there is quite a difference between the size of boy's and girl's hands already regardless of whether they play instruments or not. We also decided to limit it to 11th graders since hand sizes generally increase with age so this would allow us to gather more accurate results. The null hypothesis is "There is no significant difference between hand lengths for instrument players and people that don't play instruments."

Variables

Independent: Whether they play an instrument or not
Dependent: Hand length
Controlled: Gender (Male), Measurement Method (Ruler), Grade (11th graders), left hand only

Materials

1 Ruler for measuring
1 Notebook for recording data
1 Pencil for recording data

Method (Procedure)

1. Gather the materials necessary to collect the data
2. Find random students to gather data from
3. Determine whether they play an instrument or not
4. Measure the length of their hand from the tip of the middle finger to the wrist line.
5. Record data and repeat on a different student.

Arm length (cm)(±0.1cm)	
Play an instrument	**Does not play an instrument**
18.7	17.6
18.9	18.5
18.9	18.6
19.0	18.9
19.2	19.0
19.2	19.2
19.2	19.4
19.3	19.5
19.6	20.0
19.8	
18.2	
19.0	
18.7	
20.5	
18.1	
20.1	
18.0	
17.5	
21.1	
21.1	

Data processing

1. **Calculate the mean and standard deviation for your data.**

	Play instruments	Don't play instruments
Mean	19.205	18.97
Standard Deviation	0.961	0.691
Mean + 1SD	19.205 + 0.961 = 20.166	18.97 + 0.691 = 19.661
Mean – 1SD	19.205 – 0.961 = 18.244	18.97 – 0.691 = 18.279
Student's t test	0.4576	

Calculations

Mean

PLAY AN INSTRUMENT

$$Mean = \frac{\sum x}{n}$$

$$= \frac{18.2+19.8+20.5+19+18+17.5+18.7+18.1+20.1+18.7+21.1+19+19.2+21.1+19.2+19.3+18.9+19.6+19.2+18.9}{20}$$

$$= \frac{384.1}{20}$$

$$= 19.205$$

DOES NOT PLAY AN INSTRUMENT

$$Mean = \frac{\sum x}{n}$$

$$= \frac{18.5+17.6+19+18.6+19.5+20+18.9+19.2+19.4}{9}$$

$$= 18.97$$

Standard deviation

2. **Make a graph of your data in the form of a frequency table. Show the distribution of your data so that you can determine if you have a normal**
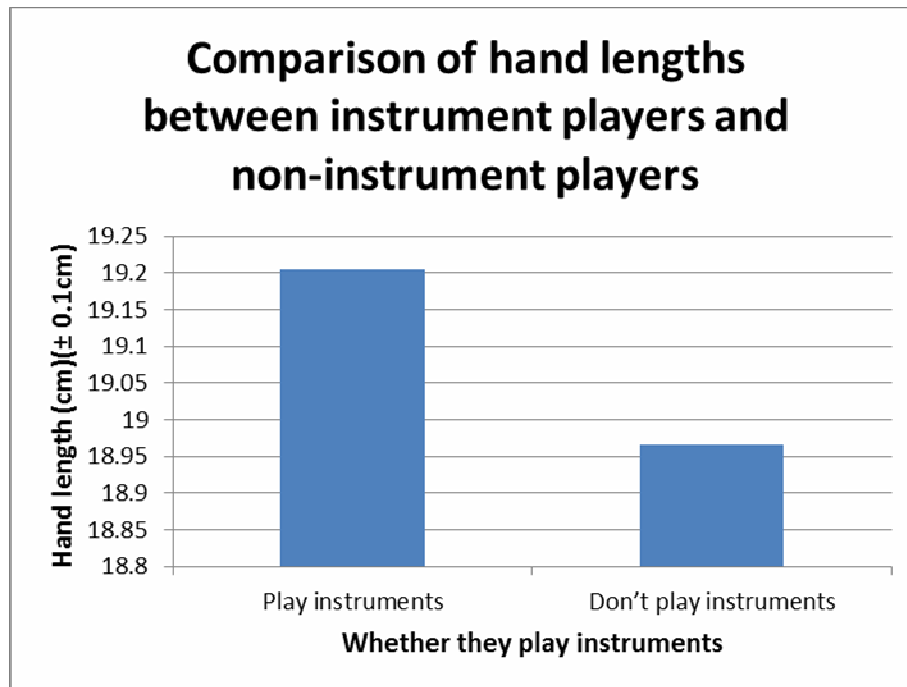
distribution or not.

As shown in this graph, the mean of hand lengths for people that play instruments is significantly higher than people that do not play instruments. However if we take into account the uncertainty then there really isn't too big of a difference. If not considering the uncertainty then this graph would support the hypothesis.

| Frequency table for instrument players		
Interval	Tally	Frequency
17.0 – 17.4		0
17.5 – 17.9		1
18.0 – 18.4		3
18.5 – 18.9		4
19.0 – 19.4		6
19.5 – 19.9		2
20.0 – 20.4		1
20.5 – 20.9		1
21.0 – 21.4		2

Distribution graph for instrument players
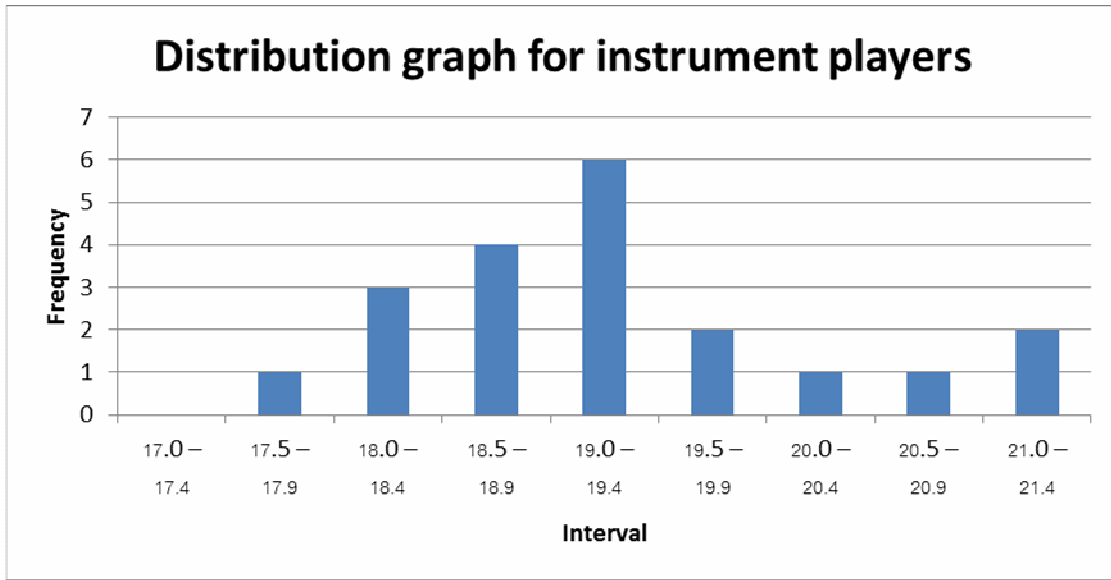
As you can see from the graph, although it is a little skewed on the right side it seems pretty close to a normal distribution. From the calculations above we figured out that the mean plus one standard deviation is 20.166 and minus one standard deviation would be 18.244. From the graph we see that most of the data do lie between one

Frequency table for non-instrument players		
Interval	Tally	Frequency
17.5 – 17.9		1
18.0 – 18.4		0
18.5 – 18.9		3
19.0 – 19.4		3
19.5 – 19.9		1
20.0 – 20.4		1

standard deviation from the mean.

Distribution of data for non-instrument players
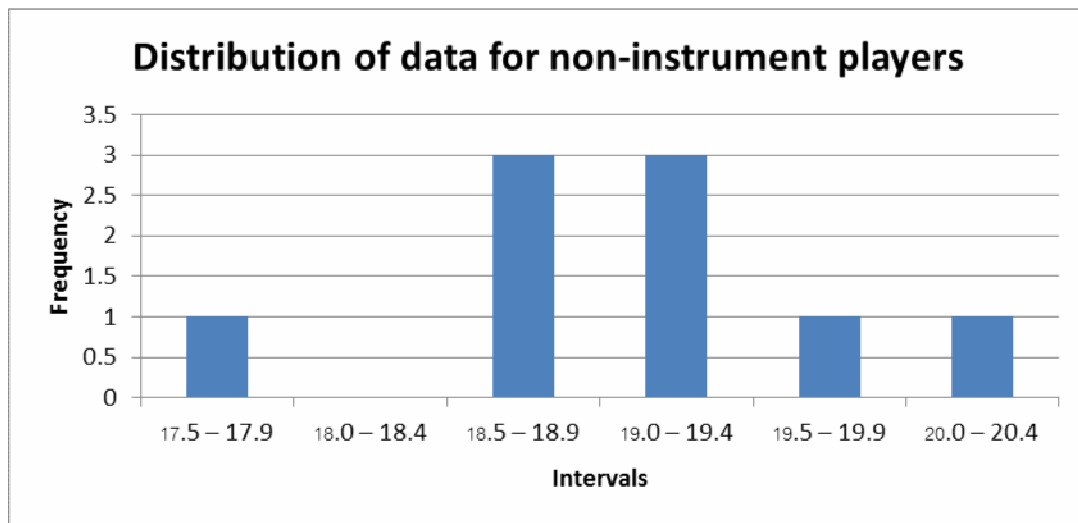
The distribution for non-instrument players is also relatively similar to the normal distribution except that it is empty between 18.0 to 18.4. As calculated earlier the one standard deviation above the mean would be 19.661 and one standard deviation below the mean would be 18.279. From looking at the graph the bulk do the data does lie between that range but there is some data outside of that range.

Error bar for instrument players and non-instrument players
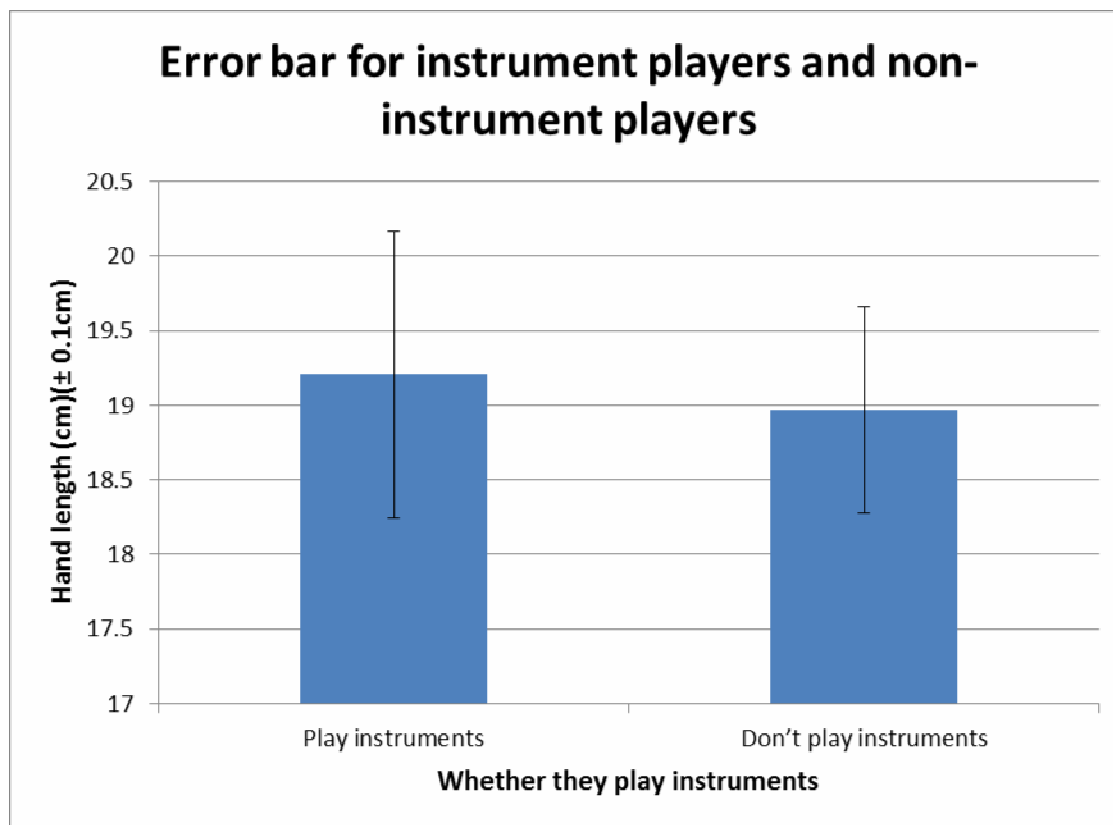
From this error bar we can tell that much of the data does overlap which means that there is no significant difference between playing an instrument and not playing an instrument. This supports the null hypothesis.

Conclusion

From simply looking at the comparison between the means it seems like there a significant difference. However, when doing the Student's t test it turns out there is a 45.76% possibility that it was because of chance, this means that there is only a 54.24% chance that there is a significant difference between people that play instruments and people that don't. In biology a 54.24% chance is much too less to assume that it has a significant difference, at the very least we would need to have 95%. So, we reject the hypothesis and accept the null hypothesis.

Evaluation

There were many factors that could have caused our data to be inaccurate. One that we had tremendous problems on was determining whether they play an instrument or not since some people used to play instruments or some just began playing an instrument. Another one was the wrist line, there are more than one wrist line while for some people there was one that was more obvious some people had relatively similar wrist lines so it was hard to choose which one to measure from. Another possible source of error was the ruler. I and my partner each had a ruler and although they looked very much similar there may be minor differences between the intervals on the ruler. In order to improve this experiment we could instead measure with the same ruler to eliminate some chance of error. We could also choose a more visible point to measure from since the wrist lines vary. Finally, and most importantly, we could create a set of guidelines that would determine whether this person would fall into the instrument category or non-instrument category.