

Pulse Rates and Fitness

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INTRODUCTION: It is important for young people to understand the effect fitness level has on their bodily systems. Pulse rate is often used as a measure of whether or not a person is in good physical condition. There are two types of pulse rates: resting and exercise. A resting pulse rate occurs when a person's heart is at rest and is best measured in the morning, after a good night's sleep, or before you get out of bed. The heart beats about 60 to 80 times a minute when at rest. Resting heart rate usually rises with age, and it's generally lower in physically fit people. The exercise pulse rate occurs when a person is involved in physical activity.

NCTM STANDARDS: Measurement, Data Analysis & Probability, Communication, Connections, Representation

MATERIALS: jump ropes, stopwatch, graphing calculator

GOALS: Students will measure and record resting and exercise pulse rates. They will create box plots to represent class data and to reflect on the effect of fitness level on pulse rate.

ACTIVITIES:

Part I: Introduction

Teacher will demonstrate how to find a pulse rate using either the carotid artery on the side of the neck or the radial pulse on the wrist. The teacher will also review how to construct box and whisker plots using the calculator as well as the meanings of outliers, extremes, median, mean, and quartiles.

Part 2: Measure Pulse Rates

In groups, students will first have his/her pulse rate recorded. Then they will jump rope for two minutes and then have the exercise pulse rate recorded. Finally, after one minute of rest, they will record the pulse rate again.

Part 3: Compile Data and Construct Box Plots

After recording the pulse rates, students will go to the board and put the pulse rates of their group on the board. Once the class' data is compiled, students will put the sets of data in their calculators and create box plots or construct them by hand.

ASSESSMENT: Students will answer questions based on the box plots created. Students will use their knowledge of box plots and measures of central tendency to answer questions about the effects of fitness level on pulse rate.

Part I: Introduction

Teacher will demonstrate how to find a pulse rate using either the carotid artery on the side of the neck or the radial pulse on the wrist. To find a pulse using the carotid artery, place two fingers underneath the jaw-line near the ear. To find a pulse using the radial pulse, place two fingers on the bottom of the wrist near the palm of the hand. Many students will have trouble finding a pulse using the wrist, so encourage your class to use the carotid artery.

Pulse rate is measured in beats per minute (bpm). When measuring resting pulse rate, students can count the number of beats for 15 seconds and then multiply by 4 to get the rate. However, when measuring the exercise pulse rate, make sure and remind students to count beats for the full 60 seconds since the number of beats will slow as students cool down and time passes after activity.

In order to construct a box plot, students must complete the following steps:

- Enter their data into a list by going to STAT then Edit.
- Then, they enter their data into L1.
- To get out, press 2nd MODE.
- Next, they press 2nd “Y=” to take them to the STAT PLOTS screen.
- At “1:” press ENTER. Highlight “On” and press ENTER.
- Use the arrow keys to select one of the two box plot types (and press ENTER).
- The difference between the two is that the first one shows outliers.
- Finally, press ZOOM then 9:ZoomStat. The box plot should appear.

On the box plot, there will be 5 key components presented:

minX is the smallest valued data entry
maxX is the largest valued data entry
Q1 is the lower quartile (25th percentile)
Q3 is the upper quartile (75th percentile)
Med is the median (middle) value

Other noteworthy vocabulary are:

Outliers: Any data observation which lies more than $1.5 \times \text{IQR}$ lower than the first quartile or $1.5 \times \text{IQR}$ higher than the third quartile

Extremes: Any data observation which lies more than three times the IQR to the left and right from the first and third quartiles

Mean: the average of the data set

Part II: Measure Pulse Rates

Have students pair up and give each group one jump rope and one stop watch and follow these instructions:

- 1) Relax for a minute or two.
- 2) Working with your partner, find your resting heart rate by counting the beats per minute for 15 seconds and multiplying this number by 4.
- 3) Jump rope for 2 minutes
- 4) Find heart rate immediately following exercise and record on paper
- 5) Rest for 1 minute recovery period (while your partner is recording exercise heart rate)
- 6) Find heart rate after 1 minute recovery period and record
- 7) Subtract the 1 minute recovery period pulse rate from the exercise pulse rate and record. We'll call this the post-exercise pulse rate drop

Part III: Compile Data and Construct Box Plots

After each group has completed the activity, they should go to the board and anonymously record the resting pulse rate, the exercise pulse rate, and the post-exercise pulse rate drop of both group members on a chart on the board. This chart can be a stem and leaf plot or can simply be numbers listed for each type.

After compiling the data, the students must create box plots for each of the three data sets using their calculators. The teacher will also construct the three box plots on a calculator and project the image onto the overhead or TV screen.

Part IV: Assessment

Students will be asked to get back into their groups for a think-pair-share activity. In their groups, they will interpret the graphs they've made. Be sure to remind students that they are not only comparing centers, but also spreads and shapes of the graphs.

Students should also specifically discuss the box plot for recovery heart rate. Using the scale below, what percentage of the class is in excellent shape? In average shape? In poor shape?

Excellent: drop of 50 beats or more

Average: drop of 30-45 beats

Poor: drop of fewer than 30 beats

Then, they are to write a journal entry answering these two questions:

- 1) How would you describe the average fitness level of the class based on the results? Do you think people who consider themselves athletes have better scores than those who do not?
- 2) How could a physician or a personal trainer use your results to determine whether a client is in good physical condition?

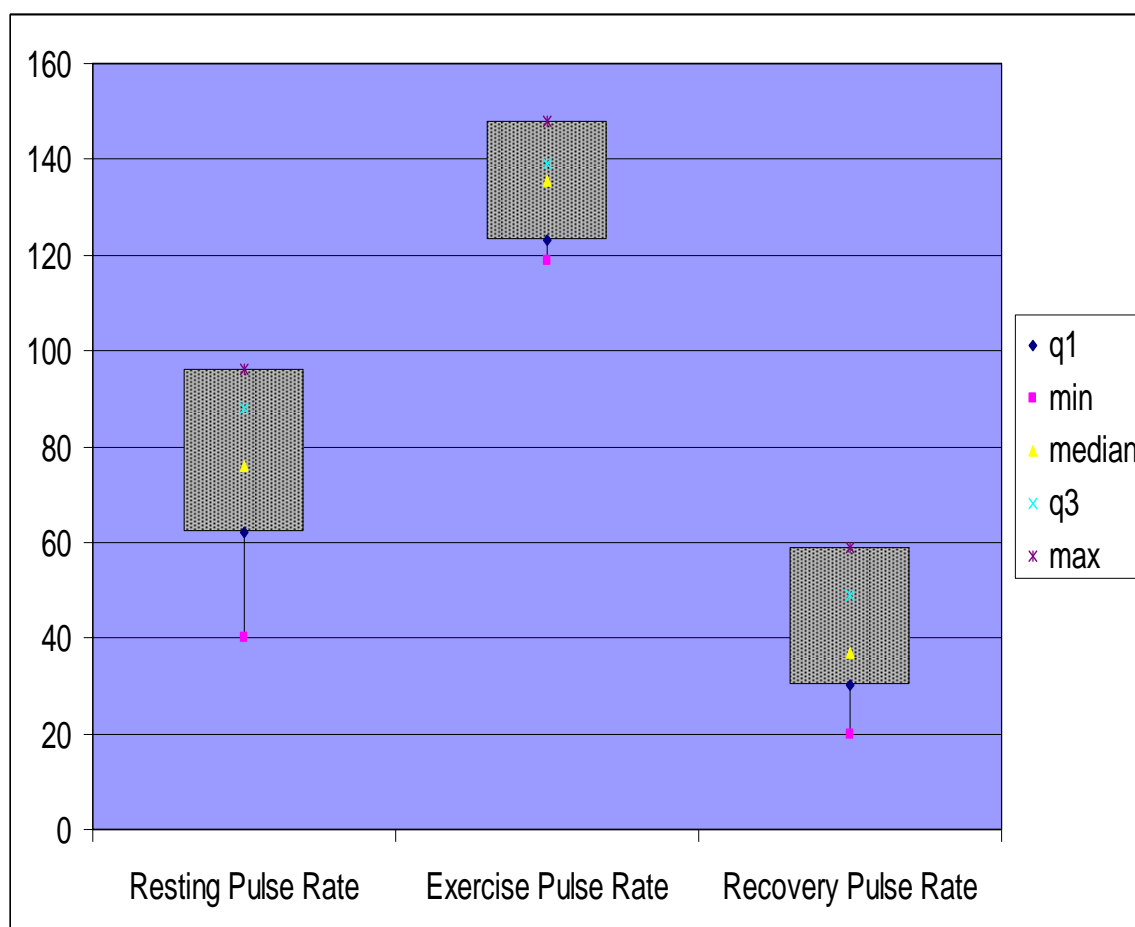
Extension Questions

- 1) With any form of measurement, there is always error. In looking at our methods for measuring pulse rate, where could error have occurred? What could we do to limit error?
- 2) Maximum heart rate is the maximum heart rate that a person should achieve during maximal physical exertion. Also, target heart rate takes your fitness level into account and prescribes a range that your heart rate should fall into during exercise. If maximum heart rate is found by subtracting your age from 220 and your target heart rate is 50-85% of your maximum heart rate, what is your target heart rate? How would you use this information when designing a fitness plan for yourself?

Sample Data Set and Solution

<u>Student</u>	<u>Resting Pulse Rate</u>	<u>Exercise Pulse Rate</u>	<u>Recovery Pulse Rate</u>
A	96	148	20
B	94	147	24
C	92	145	25
D	90	143	26
E	89	141	27
F	88	139	30
G	88	139	30
H	86	138	30
I	85	138	32
J	84	137	32
K	82	137	33
L	80	136	33
M	77	136	35
N	75	135	39
O	73	134	44
P	70	133	46
Q	69	133	46
R	68	129	47
S	65	125	48
T	62	123	49
U	58	122	50
V	55	121	52
W	50	121	55
X	48	120	56
Y	45	120	57
Z	40	119	59

Statistic	Resting Pulse Rate	Exercise Pulse Rate	Recovery Pulse Rate
q1	62	123	30
min	40	119	20
median	76	135.5	37
q3	88	139	49
max	96	148	59



For information on how to graph box plots in Excel, visit:

<http://www.mis.coventry.ac.uk/~nhunt/boxplot.htm>