



ACTIVITY 2

Measuring Well-Being

LABORATORY

Some devices can measure
a wide range of health
metrics, such as heart
rate and sleep patterns.





2 : MEASURING WELL-BEING

GUIDING QUESTION

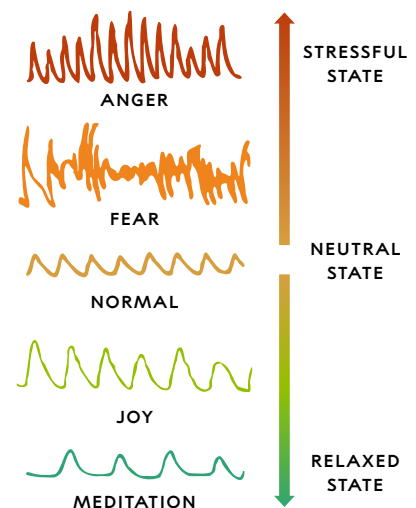
What are the challenges of studying well-being?

INTRODUCTION

Dr. Michael Otto likes to give simple advice on well-being: “Go out for a walk. You’ll feel better.” Dr. Otto is a professor in the Psychological and Brain Sciences department at Boston University. Based on years of research, he and his colleagues recommend exercise to improve well-being. While Dr. Otto’s advice seems straightforward, his research is part of a larger effort to understand how well-being is influenced by both mental and physical factors.

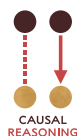
To understand well-being, researchers investigate its effects on both the mind and the body. This includes everything from studying emotions to measuring physical changes. Emotional well-being can be measured by observing behavior or asking people questions about their moods and feelings. Some measurable physical signs that relate to well-being include changes in heart rate, breathing, and hormone levels. In this activity, you will test if exercise can improve well-being, and you will investigate the challenges of studying it.

FIGURE 2.1
Breathing Patterns for
Different Emotions



The graph shows the patterns and rates of breathing for different emotional states over 25 seconds. Each peak represents one breath.

CONCEPTUAL
TOOLS



If you need to review the concept of body systems related to exercise, you will find a Science Review at the end of this activity.

MATERIALS LIST

FOR EACH PAIR
OF STUDENTS

TIMER

CALCULATOR

STUDENT SHEET 2.1
"Measuring Physical
and Mental Responses
to Exercise"

PROCEDURE

- 1 Read the following fictional scenario as a class.

Pedro is a student at Salas High School and would like to recommend exercise as a well-being strategy. However, he has doubts about whether it will have a measurable difference. Speaking to the Well-Being Task Force, he says, "I think it might be difficult to evaluate the well-being of students and learn if our recommended strategy actually has a positive impact. I am not even sure someone can reliably measure a student's feelings or well-being. I mean, people react differently to situations, and their emotions change all the time!"

The Well-Being Task Force decides to explore Pedro's concerns further. They ask biology students at Salas High School to compare physical and mental measurements of well-being before and after exercise.

- 2 You will be working in pairs to test if exercise causes a change in well-being by measuring heart rate, mood, and alertness levels. Decide which partner will take the exercise test and which partner will be the timer and record the data on a student sheet.
- 3 Discuss the following questions with your partner. Record your ideas in your science notebook.
 - a Your class will be averaging the data from many students who are doing the experiment. How does this help to improve the accuracy of the results? Explain your answer.
 - b In your class data, do you think it will be more difficult to notice changes in heart rate, mood, or alertness? Explain your prediction.
- 4 Prepare to have your test partner measure their heart rate before exercising by having them sit comfortably.

- 5 Your test partner will measure their average heart rate while you record the data in the Before Exercise table on Student Sheet 2.1, “Measuring Physical and Mental Responses to Exercise.”
- a Have your test partner use the first two fingers of one hand to locate their pulse at the base of their wrist or on the side of their neck.
 - b Have your test partner count their heart beats for 30 seconds while you keep track of time.
 - c Multiply the 30-second pulse by 2 to calculate your test partner’s heart rate for 60 seconds. Record the data for Trial 1 in the Before Exercise table.
 - d Repeat Steps 5a–5c two more times and record the data for Trials 2 and 3 in the Before Exercise table and calculate the total for all three trials.
 - e Calculate your test partner’s average beats per minute by dividing the total by 3 and recording it in the bottom row of the Before Exercise table. Then, record the average beats per minute in the “Before Exercise” row of the Data Table for Test Partner (at the top of the student sheet).



Locating the pulse on the wrist below the base of the thumb.



Locating the pulse on the side of the neck.

- 6 Have your test partner rate their alertness and mood on a scale of 0 to 10 (with 0 being the lowest and 10 being the highest). Record their ratings in the “Before Exercise” row in the Data Table for Test Partner on the student sheet.
- 7 Wait for your teacher’s instructions. When you get the signal to do so, have your test partner exercise once for 3 minutes and then immediately repeat Steps 5a–5e for your test partner to measure their heart rate. Record all 3 trials and calculate the average beats per minute in the After Exercise table. Then, record the average beats per minute in the “After Exercise” row in the Data Table for Test Partner (at the top of the student sheet).
- 8 Repeat Step 6 to measure your test partner’s alertness level and mood. Record their ratings in the “After Exercise” row in the Data Table for Test Partner.
- 9 Calculate your test partner’s change in heart rate, alertness, and mood by subtracting the before measurement from the after measurement. Record the results in the “Change in Each Measure” row of the Data Table for Test Partner.

- 10 As a class, compile and calculate a class average for each variable before and after exercise:

- heart rate
- alertness
- mood

Review the data and graphs displayed by your teacher. Discuss any changes you noticed between the before exercise data and the after exercise data.

- 11 With your test partner, consider other reasons for what could have caused the average changes for the class. Instead of the exercise they just performed, identify other factors that might have affected your test partner's:

- heart rate
- alertness
- mood

Record your ideas in your science notebook and be ready to share them with the class.

- 12 An **alternative explanation** is another possible explanation for a result, such as an unnoticed variable or random chance. With your class, discuss which alternative explanations might have influenced your class results.

- 13 Using your work from Steps 10–12, how sure are you that exercise improves mood? Explain your reasoning, using data and your ideas for alternative explanations. Record your ideas in your science notebook.



Running is a popular activity that many people say improves their mood and well-being.

BUILD UNDERSTANDING

- ① In the class experiment, do you think it was exercise or some other factor(s) that affected your class results the most? Support your reasoning, using ideas from your class discussion.

CONNECTIONS TO EVERYDAY LIFE

- ② Imagine you have been having trouble sleeping for several weeks. A friend suggests going for a walk every night after dinner and recording how well you sleep each night to see if it helps.
 - a Do you think having this kind of data would help you decide if the walks were improving your sleep?
 - b What other data could you record that might offer alternative explanations for a change in well-being?

EXTENSION

In many well-being studies, researchers use subjective measurements, which means that people report their own feelings instead of using an outside measurement that is the same for everyone. Watch a video and do your own research to explore why scientists consider surveys of subjective well-being to be reliable tools for measuring mental well-being.

KEY SCIENTIFIC TERMS

alternative explanation

SCIENCE REVIEW

The Circulatory and Respiratory Systems

A body system is a group of organs and structures that work together to perform a specific function in the body. The circulatory system, also known as the cardiovascular system, is made up of the heart, blood vessels, and blood. The heart pumps blood through the blood vessels to deliver oxygen and nutrients to all parts of the body. The rhythmic pulsation that you feel in your wrist or neck is called a pulse, and it happens every time your heart beats. The number of heartbeats per minute is called your pulse rate or heart rate.

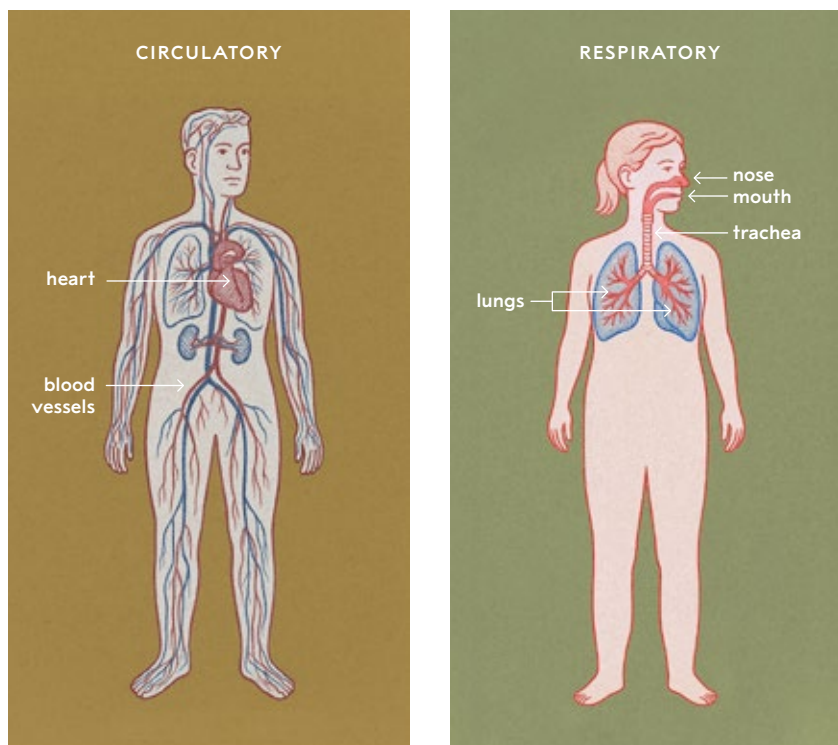


FIGURE 2.2
The Circulatory and Respiratory Systems

The respiratory system works alongside the circulatory system to provide oxygen to every cell in the body. It includes the lungs and the airways that lead to the lungs, such as the nose and mouth. When you breathe in, oxygen enters your lungs and moves into the blood. The heart then pumps this oxygen-rich blood to the rest of the body. Cells use this oxygen to break down food molecules, releasing the energy needed for movement, growth, and other functions.