

## LESSON 4: USING SCALES TO MEASURE EXERCISE INTENSITY

### Grade-Level Outcomes

#### Primary Outcome

**Fitness knowledge:** Defines resting heart rate and describes its relationship to aerobic fitness and the Borg Rating of Perceived Exertion (RPE) Scale. (S3.M13.6)

#### Embedded Outcomes

**Fitness knowledge:** Differentiates between aerobic and anaerobic capacity, and between muscular strength and muscular endurance. (S3.M10.6)

**Working with others:** Accepts differences among classmates in physical development, maturation and varying skill levels by providing encouragement and positive feedback. (S4.M4.6)

### Lesson Objectives

The learner will:

- define resting heart rate.
- use a rating of perceived exertion (RPE) scale to estimate exercise intensity.

### Equipment and Materials

- OMNI Scale for rating of perceived exertion (with pictures of riding a bike)
- Children's Effort Rating Table (CERT) (1-10)
- OMNI Scale with pictures of walking to running (0-10)
- Borg Rating of Perceived Exertion (RPE) Scale (6-20)
- Fitnessgram PACER cadence or music
- Sound system to play cadence
- Cones to mark off PACER course distances of 15 meters, 17 meters, and 20 meters
- Data collection card for RPE and PACER, with one column for PACER lap and the other column for RPE
- Pencils
- Graph paper
- Clipboards
- Whiteboard easel

### Introduction

*Today, we will continue our exploration of exercise intensity. Remember, you have a project coming up for which you will need to record your physical activity for two weeks in a log. Part of this log will include recording exercise intensity. Today's learning experience is one example of many ways that exercise intensity can be estimated and recorded.*

*Who can define heart rate? Yes, we usually measure it in beats per minute. What is resting heart rate? What is the ideal score for resting heart rate? We will explore heart rate and scales for measuring it in today's lesson.*

### Instructional Task: Introduction of Rating of Perceived Exertion (RPE) Scale (1-10)

#### ■ PRACTICE TASK

Show students two or three RPE scales from 0 to 10 and 1 to 10 and explain how they work. Explain how the scales are used.

**Guiding questions for students:**

- Let's form a hypothesis. If we were to run the PACER and you could not maintain the pace any longer, at what number do you think you would be?
- How can these scales be used for estimation and for production?
- What do you think these scales represent?

**Student Choices/Differentiation**

Have examples of various scales available.

**What to Look For**

Students use vocabulary such as intensity, exercise, increasing.

## Instructional Task: PACER Calibration

**■ PRACTICE TASK**

Students will work in pairs while performing the PACER (Progressive Aerobic Cardiovascular Endurance Run).

The PACER is to be run in two heats. The students performing the PACER tell their partners what number they perceive each time they return. The partners are seated or standing at the end of the course with a pencil, data collection sheet, chosen scale, and clipboard. When the runners approach the data collectors (partners), the partners shows the scale so that the runners can report how they currently feel.

Data is collected every other lap. Students switch roles when everyone has completed the PACER in heat one.

**Extension**

Provide students graph paper or a spreadsheet on a computer to graph the RPE against PACER laps.

**EMBEDDED OUTCOME: S4.M4.6.** Students should encourage classmates and accept differences in fitness levels during the PACER test and graphing sessions. Reinforce students who provide encouragement.

**EMBEDDED OUTCOME: S3.M10.6.** The PACER test provides an opportunity to check students' understanding of aerobic and anaerobic capacity and muscular strength and endurance.

**Guiding questions for students:**

- Is the PACER test primarily a test of aerobic or anaerobic capacity?
- Why do you think so?
- Is the PACER test primarily a test of muscular strength or muscular endurance? Why?

**Student Choices/Differentiation**

- Allow students to choose which RPE scale they would like to use (riding bike 0 to 10, walk/run 0 to 10, or CERT 1 to 10 with no pictures). Please note that in some communities, some children may not know what it is like to ride a bike, and some may not know what it is like to ride a bike up a hill. Consequently, the walk/run scale may be more appropriate.
- As an option, PACER courses of different lengths can be set up to provide additional conditioning for students who typically do not perform very many laps. Distances of 15 meters, 17 meters, and 20 meters seem to work well when using the 20-meter distance cadence from Fitnessgram.

**What to Look For**

- Are students working well together with reporting and recording scores?
- Do students tend to finish the PACER with an RPE of 10?

- Formative assessment: Students/teacher should see that the RPE increases in a linear fashion with the increase in number of PACER laps. They should also see that they were at a level 10 when they could not continue the PACER any longer. If the RPE is not linear, and they stopped the PACER before they were at a 10, there is a calibration issue.

## **Instructional Task:** **Presentation of Two Scales and Debrief**

### ■ **PRACTICE TASK**

Show depictions of the different children's scales (OMNI and CERT) next to the Borg Rating of Perceived Exertion (RPE) Scale.

Explain the limitations of both scales: overestimation of RPE and subjectivity versus objectivity. The scales are subjective in nature compared with objective feedback that you get from an exercise machine that provides speed, power (watts), and Calories burned, or from a cell phone app that provides speed, distance, Calories burned, and heart rate.

#### **Guiding questions for students:**

- Here are two scales (Borg and 0 to 10). Notice how one is from 0 to 10 and the other is from 6 to 20. Both are used to estimate exercise intensity. Why do you think we have both of these?
- Based on the Borg scale, and the fact that you are sitting here at rest listening to me, what number would you choose?
- How accurate do you think these scales are?
- Why would a teacher use them?

#### **Extension**

Let students take one or more of the scales home with them. These are options to be used with their upcoming project: a two-week physical activity log.

#### **Student Choices/Differentiation**

- Provide many examples of the two scales.
- For the activity log project, allow students to use the RPE scales despite teaching them the more objective options.

#### **What to Look For**

- Students understand the difference between subjective and objective assessments.
- Students can answer 6 when at rest and using the Borg scale.
- Students are able to explain the difference between the two scales.

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### **Formal and Informal Assessments**

- Modified Fitnessgram PACER
- Recording of PACER laps and course attempted
- Reporting RPE to a partner
- Graphing RPE and PACER laps

### **Closure**

- How do you feel after the PACER test?
- Would you do anything differently if you took it again?
- Do you have any questions about how to use an RPE scale?

## Reflection

- Do students seem to understand the use of the RPE scale?
- Does use of the RPE scale seem to result in better engagement in the PACER?

## Homework

*When participating in various physical activities, think about your exercise intensity. See if you can apply what you learned today to the games you play at recess. This will be important when you eventually record your physical activity for two weeks.*

*Take home your data collection sheet and finish graphing your PACER and RPE data. A sample of a completed graph is on the school's physical education website.*

*Continue your physical activity log. Be sure to include today's activities in physical education and activities you do outside of school or during various times throughout the school day.*

## Resources

Astrand, P.O. (1952). *Experimental studies of physical working capacity in relation to sex and age*. Copenhagen: Munsksgaard.

Astrand, P.O., & Rodahl, K. (1986). *Textbook of work physiology: Physiological bases of exercise*. New York: McGraw-Hill.

Brooks, G.A., Fahey, T.D., White, T.P., & Baldwin, K.M. (2000). *Exercise physiology: Human bioenergetics and its applications*. Columbus, OH: McGraw-Hill Education.

Rowland, T.W., & Bar-Or, O. (2004). *Pediatric exercise medicine: From physiologic principles to health care applications*. Champaign, IL: Human Kinetics.

Internet keyword search: "running scale"

# BORG RATING OF PERCEIVED EXERTION SHEET

## Directions for Partner Borg Rating of Perceived Exertion (6-20)

You will perform the PACER test. As you know, PACER stands for Progressive Aerobic Cardiovascular Endurance Run. We will use three different-length courses for the PACER: a 15-meter, a 17-meter, and a 20-meter. You may choose the distance based on your current fitness level. Remember, if you typically run 15 to 20 laps, the 15-meter course will keep you in longer, which will help you work on your endurance. This is a form of overload.

I will show you a scale during the PACER each time you run toward me, and I will ask you how hard you are exercising. Please give me a number between 6 and 20 that best describes how you're feeling at that moment. Some of the numbers have words or pictures next to them to help you. You can choose any number between 6 and 20, not only those numbers that have words or numbers next to them.

There is no right or wrong answer. Today, we are just trying to learn how you feel during the exercise.

Script modified from: O. Bar-Or and T. Rowland, 2004, *Pediatric exercise medicine: Physiological principles to health care application* (Champaign, IL: Human Kinetics).

### The Children's Effort Rating Scale (CERT)

1	Very, very easy
2	Very easy
3	Easy
4	Just feeling a strain
5	Starting to get hard
6	Getting quite hard
7	Hard
8	Very hard
9	Very, very hard
10	So hard I'm going to stop

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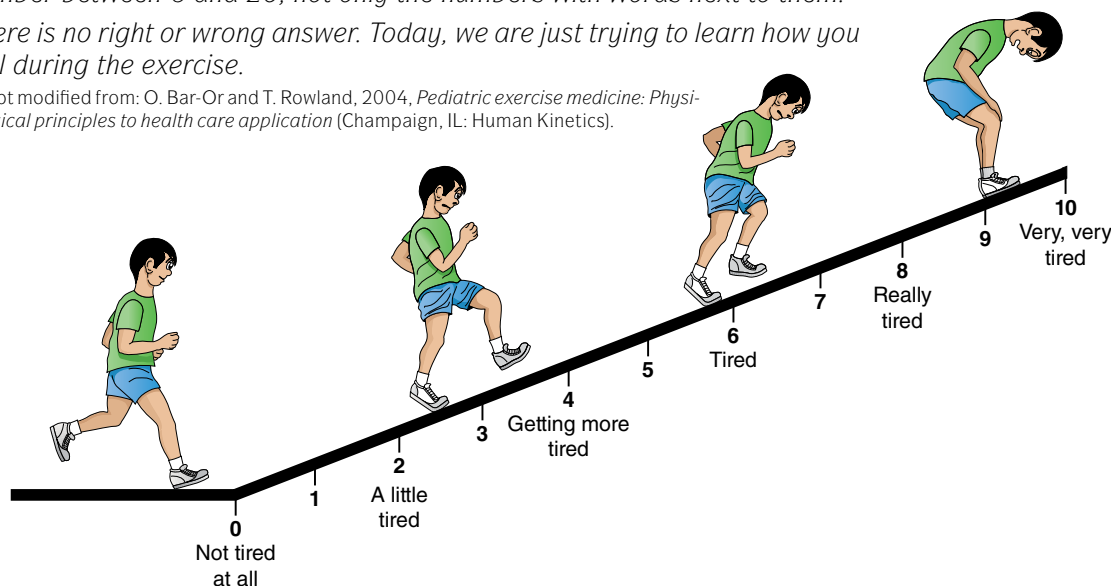
## Directions for the Children's Effort Rating Table (CERT: 1-10)

You are going to perform the PACER. As you know, PACER stands for Progressive Aerobic Cardiovascular Endurance Run. We are using three different-length courses for the PACER. We have 15-meter, 17-meter, and 20-meter courses. You get to choose the distance based on your current fitness level. Remember, if you typically run a lower number of laps such as 15 to 20 laps, the 15-meter distance will keep you in longer and you will be able to work on your endurance. This is a form of overload.

I will show you a scale during the PACER each time you return toward me. I will ask you how hard you are exercising. Please give me a number that best describes your feeling of the exercise at the moment. There may be words or pictures opposite the numbers to help you. You can choose any number between 6 and 20, not only the numbers with words next to them.

There is no right or wrong answer. Today, we are just trying to learn how you feel during the exercise.

Script modified from: O. Bar-Or and T. Rowland, 2004, *Pediatric exercise medicine: Physiological principles to health care application* (Champaign, IL: Human Kinetics).



Adapted from R.J. Robertson, 2004, *Perceived exertion for practitioners: Rating effort with the OMNI picture system* (Champaign, IL: Human Kinetics), 23.

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### Directions for the OMNI Rating Scale (OMNI: 0-10)

You are going to perform the PACER. As you know, PACER stands for Progressive Aerobic Cardiovascular Endurance Run. We are using three different-length courses for the PACER. We have 15-meter, 17-meter, and 20-meter courses. You get to choose the distance based on your current fitness level. Remember, if you typically run a lower number of laps such as 15 to 20 laps, the 1-meter distance will keep you in longer and you will be able to work on your endurance. This is a form of overload.

I will show you a scale during the PACER each time you return toward me. I will ask you how hard you are exercising. Please give me a number that best describes your feeling of the exercise at the moment. There may be words or pictures opposite the numbers to help you. You can choose any number between 0 and 10, not only the numbers with words next to them.

There is no right or wrong answer. Today, we are just trying to learn how you feel during the exercise.

Script modified from: O. Bar-Or and T. Rowland, 2004, *Pediatric exercise medicine: Physiological principles to health care application* (Champaign, IL: Human Kinetics).

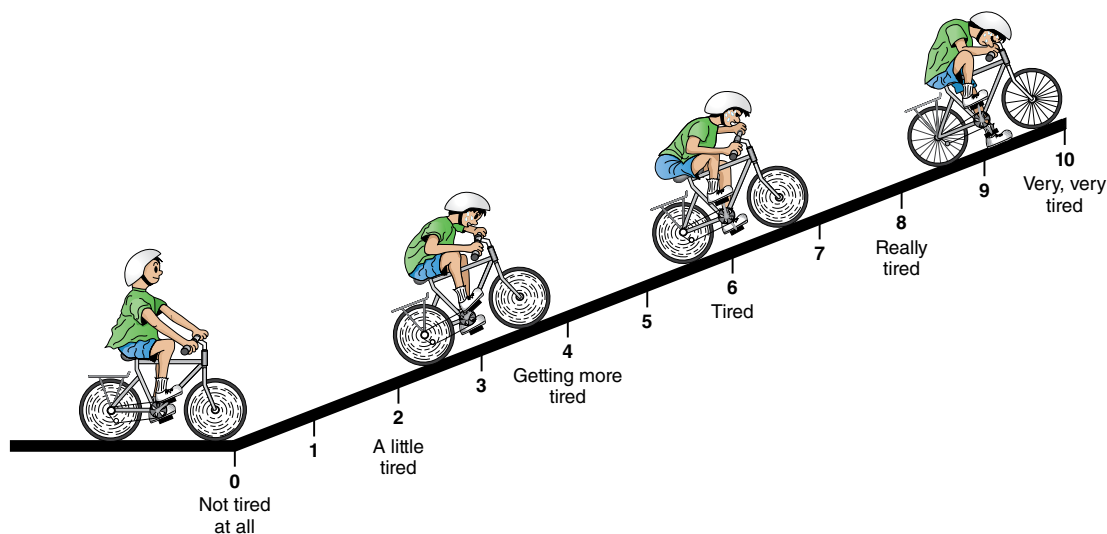
### Directions for the OMNI Rating Scale (CERT: 0-10)

You are going to perform the PACER. As you know, PACER stands for Progressive Aerobic Cardiovascular Endurance Run. We are using three different-length courses for the PACER. We have 15-meter, 17-meter, and 20-meter courses. You get to choose the distance based on your current fitness level. Remember, if you typically run a lower number of laps such as 15 to 20 laps, the 15-meter distance will keep you in longer and you will be able to work on your endurance. This is a form of overload.

I will show you a scale during the PACER each time you return toward me. I will ask you how hard you are exercising. Please give me a number that best describes your feeling of the exercise at the moment. There may be words or pictures opposite the numbers to help you. You can choose any number between 0 and 10, not only the numbers with words next to them.

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Adapted from R.J. Robertson, 2004, *Perceived exertion for practitioners: Rating effort with the OMNI picture system* (Champaign, IL: Human Kinetics), 21.

From R.J. Doan, L.C. MacDonald, and S. Chepko, eds., 2017, *Lesson planning for middle school physical education* (Reston, VA: SHAPE America; Champaign, IL: Human Kinetics).