



**TEACHER'S
GUIDEBOOK**

LESSONS FOR **LIFE**

*Individualizing Health and
Physical Education with
Heart Rate and Activity Monitoring*

POLAR®

LESSONS FOR LIFE

*Individualizing Health and Physical Education with
Heart Rate and Activity Monitoring*

POLAR®

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CONTENTS

1. INTRODUCTION	5
2. MEASURING PHYSICAL ACTIVITY	6
3. USING HEART RATE MONITORS IN SCHOOL	10
3.1 Monitoring heart rate	11
3.2 Practical guidelines for measuring heart rate	15
3.3 Heart rate -based PE lesson	19
4. IMPLEMENTING HEART RATE MONITORING IN SCHOOL	20
4.1 Lesson plans for elementary school	21
4.2 Lesson plans for middle and high school.....	24
4.3 Lesson plans for adult education	27
5. ANALYZING HEART RATE INFORMATION	32
5.1 Analyzing heart rate and evaluation.....	33
5.2 Testing cardiovascular fitness with heart rate monitors	37
6. USING ACTIVITY MONITORS IN SCHOOL	39
6.1 Monitoring daily activity	40
6.2 Practical guidelines for measuring daily activity	43
6.3 Active school day.....	45
7. IMPLEMENTING ACTIVITY MONITORING IN SCHOOL	49
7.1 Lesson plans for elementary school	50
7.2 Lesson plans for middle and high school.....	53
7.3 Lesson plans for adult education	56
8. ANALYZING ACTIVITY INFORMATION	58
8.1 Analyzing daily activity and evaluation.....	59
9. REFERENCES.....	62
10.TOOLS.....	63

1. INTRODUCTION

Lessons For Life teacher's guidebook has been written with one leading thought in mind – individualizing physical education. Inactivity is a global challenge and there is a need to find new solutions to motivate students to increase their physical activity. The feedback from teachers around the world has shown how the Polar education technology has brought PE to the next level and motivated students to do their personal best in PE. The more teachers have used heart rate and activity technology in physical education, the more we have recognized the importance of getting information about this technology to as many educators as possible.

It is a global challenge to motivate young people towards an active lifestyle. There are many factors behind the lack of participation of young people in physical activity. TV, video games, poor motivation and ignoring the benefits of physical activity are just a few of the reasons why today's children are growing up inactive. Physical and health education can have an effect on inactivity by giving support and guidance to increase physical activity in a safe way.

Researches say that lifestyle habits adopted during youth generally extend into adulthood. The best setting to reach all children is school where it is possible to offer equal possibilities for physical activity and exercising. The main target of physical education in schools should be to motivate students for lifelong activity. The aim is to enable students to develop their skills and knowledge as well as attitudes that lead to an active lifestyle.

Learning healthy habits and making changes in lifestyle requires motivation and individual commitment. Therefore, the theory basis for all the lesson plans and tips given in this book are related to problem-based and experiential learning. To gain the best learning results, we need to offer students opportunities to be actively engaged in seeking answers to real-world questions about their own health and fitness. The target is to support lifelong learning about their own health and fitness level. Tips and tools provided in this book will help teachers to advise their students to understand and experience the health benefits that result from regular physical activity.

In this book we want to support teachers and students to:

- develop skills to include regular physical activity in their everyday life
- learn to understand the meaning of their own effort in staying fit, and
- find the joy of exercising.

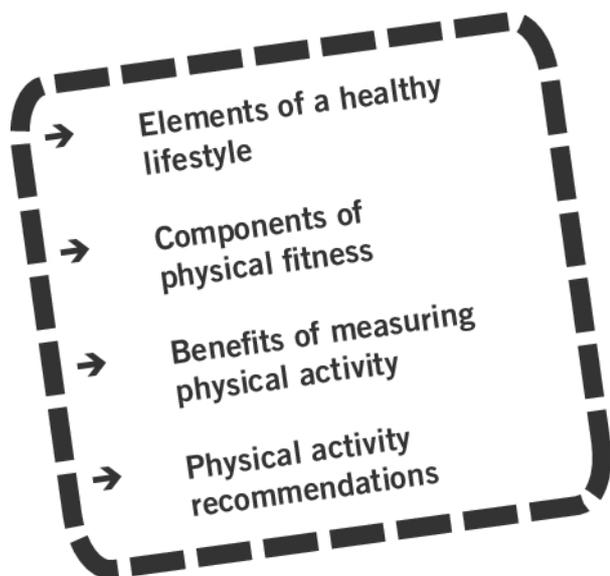
The purpose of this book is to present ideas that not only motivate children to participate in aerobic exercises, but also educate both teachers and students to the potential for assessing students based on their personal effort. Instead of comparing students to other students, they may now concentrate on competing against their own efforts. This book gives basic information about an active lifestyle, exercising and effort. It gives information about measuring daily activity and intensity during exercise and tips to analyze the data.

In this book the teacher will receive tips for using the new technology with the students to motivate them towards an active lifestyle. The tips are designed to give the teacher ideas on how to use the information that heart rate monitors and activity monitors provide for students of any age. There are many possibilities to integrate heart rate and activity data across the curriculum. This book presents only a sampling of possibilities. Once the teacher has tried the exercises mentioned in this book, they will discover even more applications of this technology in teaching-learning situations.

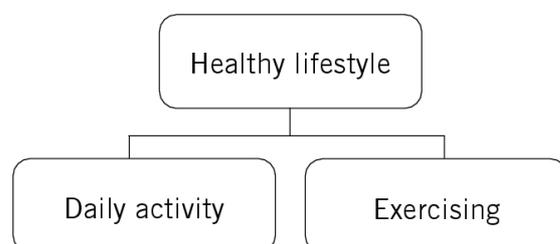
Lessons For Life is about learning to listen to the language of the heart. It is written to help teachers to support students to work towards a healthy and physically active adulthood. Its aim is also to help teachers by giving information on planning lessons, having safe and motivating PE lessons and giving fair evaluation. With the help of heart rate monitors and activity monitors, it is possible to individualize PE and give lessons for life for every student.



2 MEASURING PHYSICAL ACTIVITY



A healthy lifestyle consists of daily activity and exercising. There is a global decrease in physical activity in young people. Today's children are growing inactive; not because they are not exercising, but because their daily activity level is getting lower. A low daily activity level and inactivity are mainly due to increasingly common sedentary ways of life.



Increasing daily activity and regular exercising affect physical fitness. Health-related fitness consists of:

- Aerobic (cardiovascular) fitness - The body's ability to take in and use oxygen to supply energy throughout the body
- Muscular fitness - The strength and endurance of the muscles
- Flexibility - The ability to move joints and stretch muscles fully through their normal range of motion
- Body composition - The ratio of fat in the body compared to the lean body mass

Different types of training and exercising affect the elements of physical fitness. Aerobic fitness is a central component, because increasing aerobic fitness has many health benefits, such as prevention of several chronic diseases. Aerobic fitness can best be improved with exercise that dynamically employs large muscle groups, for example walking, running, cycling, aerobic group exercises, rowing or cross-country skiing. Muscular fitness can best be improved with weight training, but also with many cardiovascular activities like biking, running or playing sports. Flexibility can best be improved with regular static and dynamic stretching, or, for example with pilates or yoga. Body composition is an important part of health-related fitness, as too high fat percentage is a measure of higher risk for many health problems such as high blood pressure, high blood cholesterol, and diabetes. Proper nutrition and regular physical activity help maintain a healthy body composition.

WHAT ARE THE BENEFITS OF HEART RATE MONITORING AND ACTIVITY MONITORING?

The Polar education technology offers possibilities to measure both single exercises and continuous daily activity. Exercising can best be measured with heart rate monitors and daily activity with activity monitors. The greatest benefit of the Polar education technology is giving students a chance to exercise and be

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active on their individual levels of fitness. The technology enables students to be accountable for their own individual effort. In turn, you are accountable to your students, their parents and administrators because of concrete, objective data to support the grades you give.

Polar education technology is for every student. It helps all students reach their potential and gives life lessons that will stay with them forever.

Teachers: Objective feedback helps you evaluate and keep track of your students' progress and adjust the curriculum to meet all of your students' needs.

Parents: Activity reports help parents follow their children's physical activity and support them in teaching healthy habits at home.

Students: Individual, instant feedback gives students motivation to reach targets and track progress over time.

Administration: Reports of students' physical activity, trends and results help administration to follow up on the quality of education and make decisions based on actual data.

The school setting offers a possibility to encourage students to be active. But how to know if the activity opportunities in the school setting are motivating the students to actually move more? There are globally recognized activity recommendations for children and adults. How to be sure if the recommendations are really followed? It is difficult to estimate the activity during the day and it is difficult to estimate the level of intensity or effort when exercising without technology. The Polar education technology offers a solution to stop the guessing and get proof of daily activity and students' effort during exercise. Depending on the target, there are tools to get this proof. In the following chart the methods and benefits are explained in practice. The technology helps with class management and data collection freeing you, as a teacher, to focus on the most important aspect in teaching, each student's personal development.

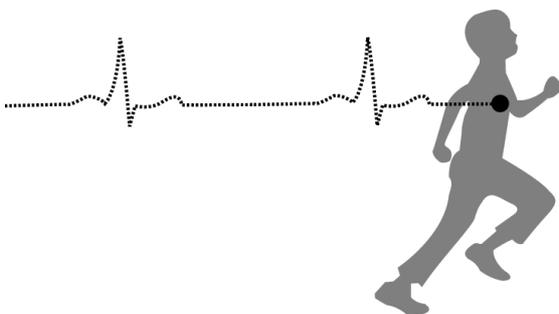
HOW TO CHOOSE BETWEEN HEART RATE MONITORING AND ACTIVITY MONITORING?

Choose heart rate monitoring:

- If you want to follow the intensity of exercising during PE classes using the data to assess effort.

Heart rate monitoring tells in detail the effect of any exercise based on individual heart rate:

- Gives students accurate real-time feedback on their exercise intensity
- Allows students to follow their fitness improvement
- Helps you educate the students to be active in different heart rate zones
- Ensures that all students are exercising safely at their individual pace

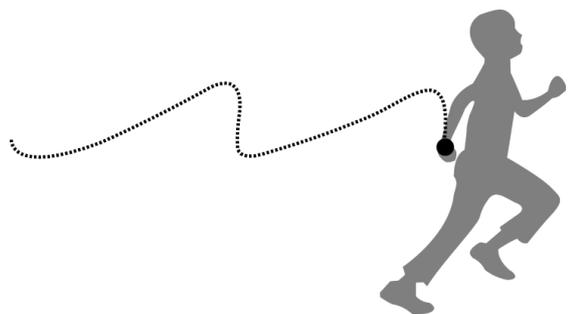


Choose activity monitoring:

- If you want to follow how active your students are during the school day

Activity monitoring tells in a simple way how active the user is based on body movement:

- Gives instant feedback on the activity level
- Tracks the quantity and quality of students' daily activity
- Helps you motivate students towards a healthier lifestyle
- Easy to measure, also suitable for younger children



To get the most out of heart rate and activity monitoring, students' activity should be followed constantly. There are many supportive elements for you to make activity and heart rate monitoring even easier in school. There are several options to choose from and something for every school's needs.

ACSM Physical activity recommendations for children and adolescents under 18 years old [1]:

- Children and adolescents should do one hour or more of physical activity each day
- Physical activity should be mostly aerobic MVPA (moderate to vigorous physical activity)
- Physical activity should include muscle-strengthening exercise
- Physical activity should include bone-strengthening activity like jumping or running
- Activities may include: walking, active play/games, dance, running, jumping rope, tennis, swimming etc.

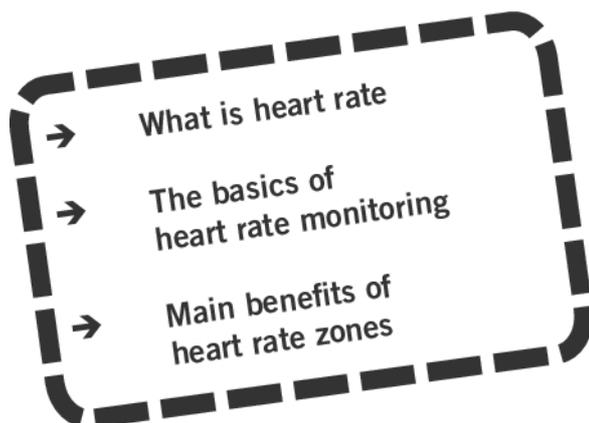
ACSM Physical activity recommendations for adults 18-65 years old [2]:

- Adults should do moderate intensity cardio training 30 minutes a day, five days a week **or** do vigorous intensity cardio training 20 minutes a day, 3 days a week **and** do eight to 10 strength-training exercises, eight to 12 repetitions of each exercise twice a week.
- Moderate-intensity physical activity means working hard enough to raise heart rate and break a sweat, yet still being able to carry on a conversation. It should be noted that to lose weight or maintain weight loss, 60 to 90 minutes of physical activity may be necessary. The 30-minute recommendation is for an average healthy adult to maintain health and reduce the risk for chronic diseases.
- Activities may include: walking, running, playing sports, swimming, biking etc.



3 USING HEART RATE MONITORS IN SCHOOL

3.1 Monitoring heart rate



WHAT IS HEART RATE?

Heart rate is determined by the number of heartbeats per unit of time, typically expressed as beats per minute (BPM). Heart rate can vary due to changes in the body's need for oxygen and provides excellent information about a person's physiology. Each person reacts to physical strain individually depending on the size of heart, fitness level, skills and daily changes of mood. Heart rate is individual and affected by personal, exercise, situational and stress-based factors. More information about these factors is available in the Tools section of this book.

WHY IS IT IMPORTANT TO MONITOR HEART RATE WHEN EXERCISING?

Heart rate is a convenient, reliable and personal indicator of the intensity of exercise. A heart rate monitor gives individual feedback by showing personal heart rate. It helps students understand their body by showing their resting, recovery, maximum and exercise heart rates. They will also learn how heart rate adapts and responds to internal and external factors. It is good to know the intensity of exercise to be able to vary it depending on the fitness level and the goals that your students want to achieve by exercising. This is smart training.

Heart rate monitoring brings many benefits to all students. With a heart rate monitor, students can make sure they exercise effectively in and out of PE classes. They can also track how physically active they are and know how hard they are working. Students' personal effort during every PE lesson can also be counted in evaluation. Heart rate monitors help accomplish fitness goals and make it easier to plan training and set targets. They also help control speed and tell the pace which is right for the student. Heart rate guides if students are running too fast or too slow for their fitness level without needing to know the actual speed. This guarantees safe exercising and avoiding injuries by controlling the exercise dose, but on the other hand it controls that exercise is intense enough to improve cardiovascular fitness. With heart rate monitors, students can see their progress and the change in their fitness level. Students who see their progress, enjoy and benefit more from PE classes.

The benefits for students that are starting exercising:

- Teaches about the body's reaction to exercise
- Keeps from starting out too hard (as beginners are often tempted to do)
- Helps control the intensity of an exercise routine - not too high or low intensity
- Provides feedback on improvement

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The benefits for students that exercise regularly:

- Helps control the intensity of the exercise in different circumstances
- Helps fine-tune the exercise program for the best results
- Gives feedback both during and after a session, teaching more about the body's reaction to exercise
- Helps track progress over time

The benefits for students that exercise and compete:

- Helps make sure that the workout is performed at the planned intensities and according to the training program (hard enough on hard days, light enough on recovery days, enough recovery between intervals, etc.)
- Enables to track and accurately adjust the training program
- Teaches about body's reaction to training, providing an early warning of overtraining, flu, etc.
- Provides feedback on progress over time

HOW TO MEASURE HEART RATE?

The best way to monitor physical effort is to measure heart rate. The higher the heart rate, the more strenuous the exercise is for the person. Monitoring heart rate is a form of biofeedback data – it tells what is going on inside the body. Although there are many subjective clues as to how the body is doing during exercise (perceived exertion, breathing rate, physical sensations), none is as reliable as measuring heart rate. It is objective and affected by both internal and external factors – meaning that it is a dependable measure of physical state. Measuring heart rate during and after the training gives individual feedback on performance. The workload of the heart can be measured in many ways – electronically or manually (the palpation method).

Measuring heart rate with a heart rate monitor

A heart rate monitor gives a physiological window, through accurate heart rate measurement, into the body's response to the moment-to-moment changes in physical activity. Monitoring heart rate isn't just about how fast the heart is beating; it also provides information about the relative intensity of the activity, the rate of energy expenditure, and indirectly, the physiological systems that are engaged to provide energy (aerobic/anaerobic). There is a direct, linear relationship between the effort (training intensity) and heart rate. In general, the higher the heart rate (i.e. intensity) during exercise, the greater the rate of energy expenditure. High intensities are usually maintained for short exercise durations.

Measuring pulse manually

In some cases, there is a need to measure the intensity manually. This is not measuring heart rate, but pulse. It might be interesting to measure heart rate by using a heart rate monitor and also measure pulse manually and then compare the values. Usually pulse is lower, because the body can recover very fast when you stop moving. Therefore, pulse is not as accurate and reliable measure of intensity as heart rate.

How to find your pulse:

- Wrist: Find the tendon running down the center of the inside of your arm. Take pulse on the thumb side of the tendon.
- Neck: Take pulse on the carotid artery next to the Adam's apple. Notice: Do not press too hard as the carotid artery is pressure-sensitive.

The difference between heart rate and pulse

Heart rate is the number of heart beats per minute (bpm). Heart rate is most accurately measured from the thorax with a heart rate monitor or the electrodes of an electrocardiograph (EKG). Pulse is the mechanical pulse of blood flow through the capillaries caused by the contractions of the heart per minute. Pulse can be measured, for instance, from an earlobe with a pulse meter. Pulse meters are not very

reliable when used outside because of the changes in the ambient light. In addition, they are rather sensitive to body movements and are not accurate during intensive exercise. Palpating is neither an accurate method to measure exercise heart rate. If the exercise pulse is measured manually, the measurement should be done immediately after stopping because heart rate starts to slow down as the body recovers. A heart rate monitor allows for continuous ECG accurate measurement of the heart rate.

HEART RATE TERMINOLOGY

Maximum heart rate (HR_{max}): The highest number of heart beats per minute. HR_{max} can be defined by having it measured clinically in a maximal exercise stress test or in a field test by an experienced physiologist or coach. HR_{max} can also be estimated by using a formula.

Formula for adults: For adults, there is a mathematical formula that allows to predict HR_{max} . It is called the "age-based formula". The age-based HR_{max} formula is useful when a physician-supervised stress test cannot be taken. The generally accepted error in the age-predicted formula is $\pm 10-12$ bpm, which is due to different inherited characteristics and exercise training.

$$220 - \text{age} = \text{age-based } HR_{max}$$

For example a 35-year-old person's HR_{max} estimation would be: $220 - 35 = 185$ beats per minute (bpm)

Formula for children (under 20 years old): Children's HR_{max} remains stable throughout childhood at least until the late teen years. This means that the formula utilized to predict maximal heart rate in adults is not applicable to children. Children's average HR_{max} is 200. Exercising at a high intensity and near maximum is natural for children. During childhood and adolescence, the maximum heart rate values are:

$$200 \pm 7 \text{ beats per minute [3, 4 \& 5]}$$

Resting heart rate (HR_{rest}): A person's resting heart rate (HR_{rest}) is the lowest number of heart beats per minute (bpm) when fully relaxed and without distractions. Adults' HR_{rest} is affected by age, fitness level, genetics, health status, and gender. It decreases as the result of cardiovascular conditioning. A normal value for an adult is 60-80 bpm, but for top athletes it can be even as low as 30 bpm. An exceptionally high HR_{rest} can be a sign of over-exertion or illness. Children's resting heart rate depends mainly on age, maturation and physical activity. The inter and intra variability of children's HR_{rest} is relatively high to be used as an indicator of fitness level. Typically, girls have higher HR_{rest} values. Resting heart rate decreases with age until adulthood. Resting heart rate is around 70-110 in children and 60-100 in adolescents. [6]

How to determine resting heart rate? Resting heart rate can be measured with a heart rate monitor. The measurement should be performed in a supine position in the morning immediately after awakening. Children's HR_{rest} can be also measured in a sitting position. The measurements should be taken on five consecutive days and then calculate the average resting heart rate. In addition to fitness, resting heart rate is affected by several factors, such as recovery from the previous exercise, the quality of sleep, and mental stress level. Therefore, the measurement should be performed only when feeling well and healthy.

Average heart rate: Average heart rate means the average of heart rates measured during an exercise period. Average heart rate indicates the average intensity of training. As a result of aerobic training, heart rate decreases at a given submaximal level of exercise for adults and children. This means that average heart rate will be lower in the same exercise with the same time, speed and power, when fitness level has improved.

Recovery heart rate: Recovery heart rate is the heart rate measured at certain intervals after exercising, often one and three minutes after completion. Adults' recovery heart rate is affected by age, gender, body mass index (BMI), and resting heart rate. Usually recovery time is longer for the adults that have a low fitness level. The recovery time is shorter, if aerobic fitness level is better. Children's recovery heart rate is affected by age, gender, BMI, and baseline heart rate. In childhood, the recovery is faster than in adulthood. Heart rate recovery is also faster in younger children than in adolescents. Boys generally have faster recovery times compared to girls. [7] There are wide individual variations in heart rate recovery times, so other indicators should be considered as well when analyzing changes in the fitness level.

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Target heart rate: A target heart rate zone is the range in which the heart rate should be to achieve the desired physiological benefits. The target heart rate is usually expressed as a percentage of the maximum heart rate. The appropriate target heart rate zone for physical exercise depends on what physiological benefits are aimed for.

Heart rate zones: The best way to achieve goals and see results is to train at the right intensity. Exercising in different heart rate zones has different benefits. Alternating between different zones improves fitness and brings variation to exercising. Heart rate zones are calculated as percentages of the maximum heart rate.

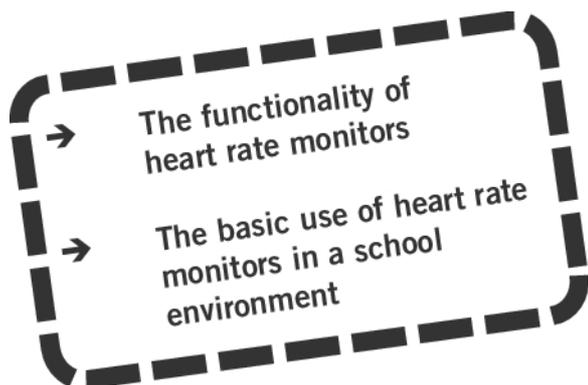
Heart rate zones for adults:

Heart rate zone	Physiological benefits	Feels like	Recommended for
90-100%	Develops maximum performance and speed	Very exhausting for breathing and muscles	Fit persons and for athletic training
80-90%	Increases maximum performance capacity	Muscular fatigue and heavy breathing	Everybody for shorter exercises
70-80%	Improves aerobic fitness	Light muscular strain, easy breathing, moderate sweating	Everybody for moderately long exercises
60-70%	Improves basic endurance and fat burning	Comfortable, easy breathing, low muscle load, light sweating	Everybody for longer and frequently repeated shorter exercises
50-60%	Improves overall health and helps to recover	Very easy for breathing and muscles	Weight management and active recovery

Heart rate zones for children (under 20-year-old):

Heart rate zone	Physiological benefits	Feels like	Recommended for
90-100%	Develops maximum performance and speed	Very exhausting for breathing and muscles	For athletic training and everybody for shorter sprints
70-90%	Improves aerobic fitness and performance capacity	Light muscular strain, easy or heavy breathing, moderate sweating	Everybody for moderately long exercises and repeated shorter exercises during the exercise phase
60-70%	Improves basic endurance and fat burning	Comfortable, easy breathing, low muscle load, light sweating	Everybody for warm-up and cool-down. Also for longer exercises and frequently repeated shorter exercises.

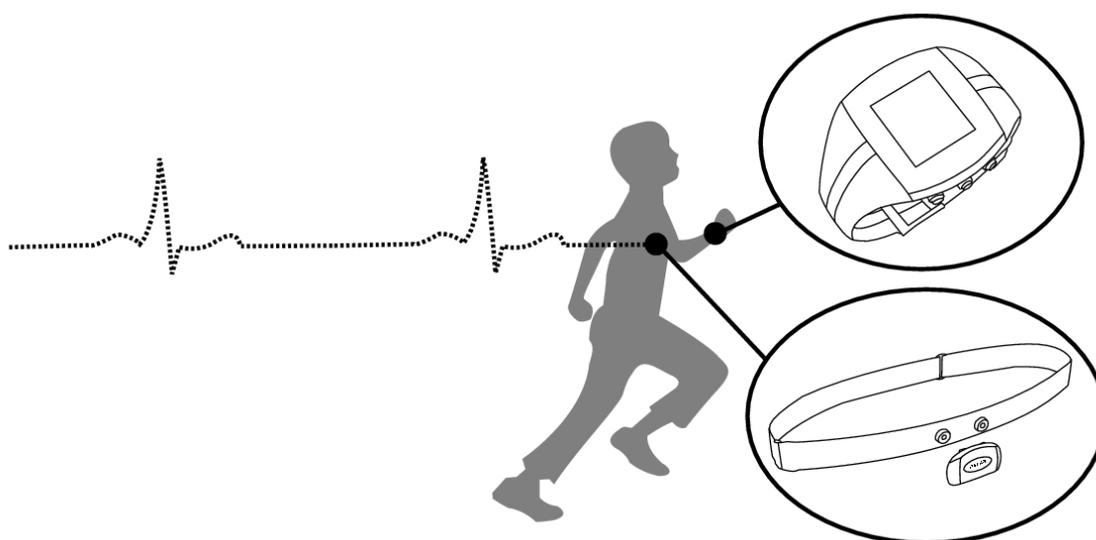
3.2 Practical guidelines for measuring heart rate



Measuring heart rate in a PE lesson should be a natural part of every lesson and used in every PE lesson. The heart rate monitors add more excitement combined with safe, objective, individual feedback on students' performance. Heart rate monitors help manage the class, freeing you to teach on a more individual level.

HOW DO HEART RATE MONITORS WORK?

Heart rate monitors have two parts: a transmitter strap that is worn around the chest and a wrist unit that receives heart rate information wirelessly and displays and records data.



Transmitter

The transmitter strap picks up heart signals and transfers the data into the wrist unit. Worn around the chest, it seamlessly adapts to the body shape, bringing full freedom of movement to exercising. The transmitter measures the electrocardiogram (ECG), the electric signal originating from the heart. It provides an accurate and reliable timing reference for the occurrence of heart beats. After picking up the electric signal from the heart, the transmitter transfers it to the wrist unit. The Polar transmitter straps are washable, and with a hook mechanism they are just as quick to put on as they are to take off. In addition, the coded transmission ensures that each heart rate monitor finds the right student's heart rate signal and not the classmate's heart rate.

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Wrist unit

The wrist unit receives heart rate signals and displays heart rate. Heart rate tells the exertion level of the body, and provides real-time information during training. The harder the exercise, the higher is the oxygen consumption and heart rate.

THE BASIC FEATURES OF A GOOD HEART RATE MONITOR

- You can see the bpm value in the monitor: To show students the exact number of heart beats
- You can see the average and maximum heart rates after the exercise: To see numeric feedback about students' effort
- You can see the percentage of the maximum heart rate in the (%HR) view in the monitor: To give guidance about the target heart rate zone for the whole group without needing to know every student's beats per minute values which might vary a lot
- You can set target heart rate zone(s) and see if the time in the target zone(s) has been reached: To plan PE lessons according to different goals (for example fitness improvement) and to see if the goals are reached
- You can see the calories spent: To teach about energy consumption and nutrition

PRACTICAL ARRANGEMENTS IN SCHOOL

Equipment:

- Heart rate monitors
 - » Label the products with numbers that correspond to the student's number in your gradebook. If you don't have enough monitors for every student, number the monitors and rotate them among your students.
- Straps
 - » If students do not have personal straps, teach them to wash the strap after use and to return them according to your guidelines. The best practice is to have a strap for each student, so they do not have to share the straps and the straps are properly adjusted for the student each time. The straps can be washed in a machine and layed out to dry. If there are not straps for every student, they will need to be washed between uses.
- Management system
 - » If you have many management systems, add letters to cases to distinguish them from each other and to make it easier to guide students to return and pick up the heart rate monitors from the correct monitor management system.
- Following the intensity of activity
 - » You can guide students during the lessons to exercise according to a specific target zone. After the lesson, you can download the files from the heart rate monitors to the Polar software for further analysis, or you can manually write down the data on a spreadsheet to collect and record the exercise files.

Basic steps during PE classes:

1. Students moisten and wear transmitter straps.
 - » Use spray bottles to make the moistening easier.
2. Students pick up their own heart rate monitors from the management system.
 - » Put the case next to the door to make it easier to pick up the monitor and at the same time advise students to be active right from the beginning of the class.
3. Students start recording in heart rate monitors before the lesson begins and stop the recording in the end of the lesson.
 - » Use quick guides on the wall to show the basic use and buttons of the monitors.
 - » Take attendance based on the monitors left in the management system. This method enables you to get your students active right away and eliminate wasted time.
4. Students return heart rate monitors to the monitor management system after the lesson.
5. Students wash the straps and leave them for you according to your guidance. If students own personal straps, they take care of those by themselves.

To make the use of heart rate monitors easy and smooth in every PE lesson, advise your students with some practical tips in the beginning of each school term. Here you can find example instructions to students:

Starting the lesson:

1. Set a target zone in your heart rate monitor, if needed.
 - » Post time in the target heart rate zone for the day on white board.
2. Start recording and warm up properly (in zone 1).
3. Follow the zone guidelines and check your zone regularly.

Ending the lesson:

1. During the cool-down, check your time in the target zones.
2. Stop the recording.
3. Wash the transmitter strap and clean the wrist unit with wipes and put it away in its place in the case.

In every lesson you are expected to:

- Put on your heart rate monitor and transmitter before the class starts
- Reach the set time in your target zone
- Wash your strap and wrist unit after the use
- Put your strap and wrist unit away correctly

Note: Follow the instructions and notify your teacher if you have any difficulties.

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Instructions for the first time you teach the students to wear the heart rate monitors

Starting up: Have your heart rate monitor ready for use

1. Putting on the transmitter strap
 - Make sure that the transmitter's electrodes are damp.
 - The two electrodes in the strap must be tightly against the chest.
 - The strap must be directly on your skin with no interference from any undergarments.
 - The connector must be facing up and positioned immediately below your pectoral muscles.
 - The strap needs to be snug without being too tight.
 - » Ask your students to raise their arms above their heads and to take a deep breath. They should feel the transmitter all the way around their chest.
2. Preparing the wrist unit
 - Select the wrist unit from the class management system.
 - Put on the wrist unit.
3. Stand-by mode and starting recording
 - Find an open area where you can spread your arms out and turn around without hitting anyone.
 - Press the Start button on the wrist unit and check that the outline around the heart symbol becomes visible.
 - On the display, you will see your heart rate and you can start the recording by pressing the Start button again.

During the lessons: Following your heart rate

1. Before a PE class starts, check the target zones.
2. During the warm-up, stay in the lower limit of the target zone.
3. Follow the time in each zone to meet the targets.
4. During the cool-down, gradually lower your heart rate.

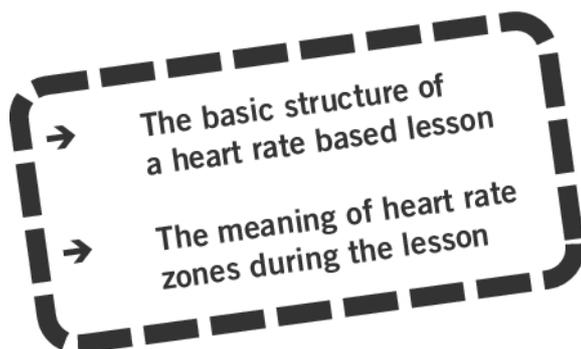
The end of the lesson: Stopping recording and checking the file

1. Press the Stop button.
2. Check your exercise file in the wrist unit.
3. Fill in your heart rate data in your heart rate log.
4. Follow your progress in the web service or from the manually collected summary reports.

Trouble-shooting: If no heart rate reading is visible

- The strap may be too loose, low or tight: re-adjust the strap
- The strap may not be wet enough: moisten the strap
- The strap may be worn backwards: make sure that the strap is the right side up with the electrodes in good contact with your skin
- Move away from interferences and restart the recording

3.3 Heart rate -based PE lesson



The goal for every PE teacher is to design the best possible PE lesson for every student. A good PE lesson's structure is similar to any training session. It includes a warm-up phase, a work phase and a cool-down phase.

The benefits of the warm-up phase

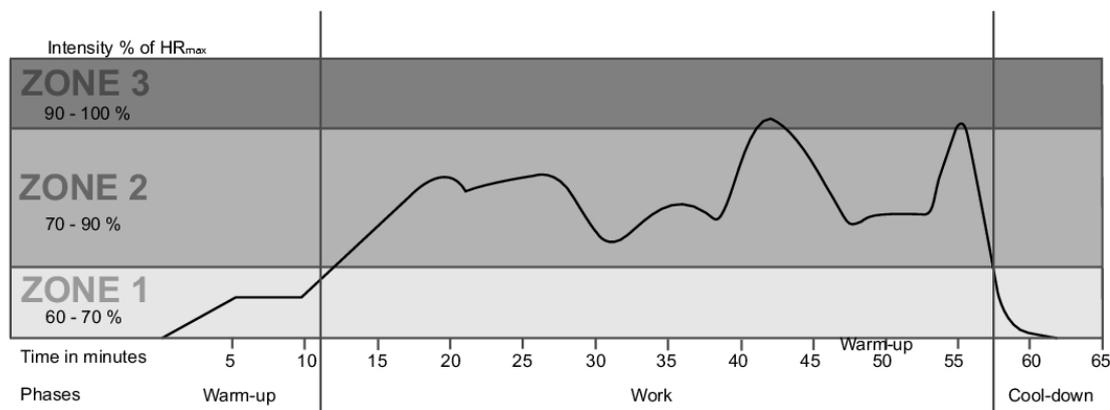
A proper warm-up prior to a PE lesson or an exercise session prepares the heart and muscles for the action ahead. It stimulates blood circulation, makes muscles more flexible and also helps preventing injuries. The warm-up prepares not only the body to be active, but also the mind. The warm-up should be planned for the exercise that will follow in the PE lesson. It should be slow enough to give the body a chance to warm up for 5 to 10 minutes at a heart rate below the selected target zone. After this, the intensity of the exercise can be gradually increased until heart rate reaches the target zone.

The benefits of the work phase

When the heart rate has reached the target zone, it should be maintained for a set time (typically 20 minutes or more). The heart rate should be monitored to be able to stay in the target zone. It is also important to be sensitive to the body's reactions while exercising. Breathing should be regular, but if feeling exceptionally breathless or dizzy, it might mean that heart rate is beyond the target zone and it is time to ease up a little. Teach the students to "live in the zone" and visit "above the zone". Staying in their target zone and periodically going above it adds variety to exercising and ensures safety.

The benefits of the cool-down phase and stretching

At the end of a session, the cool-down period ensures that the heart rate and distribution of blood flow returns to normal gently. During the cool-down, the intensity of exercise is gradually reduced to bring heart rate back down to below the target zone. Stretching of the main muscles is a part of the cool-down and prevents injuries and stiffness. Bouncing and painful stretches should be avoided. Stretching should be gentle and done slowly and steadily. It is recommended to hold each stretch for a slow count of ten.





4

IMPLEMENTING HEART RATE MONITORING IN SCHOOL

4.1 Lesson plans for elementary school

LESSON PLAN: THE SEASONS OF THE HEART

Objective: Students will learn safe exercise practices using heart rate monitors during resting, warm-up, work and cool-down phases.

Learning points:

- To understand that exercising correctly includes warm-up, work and cool-down phases in each exercise session
- To associate the seasons of nature with the seasons of the heart and natural process for an exercise session using these steps every time you exercise

Materials: Heart rate monitors, sporting equipment depending on the sport

Class duration: 45 min

Class structure:

- 5 min set-up
- 10 min warm-up
- 20 min work phase
- 10 min cool- down

Key concept and activities:

- Every exercise session should include careful monitoring of the resting, warm-up, work and cool-down phases. Tell your students "As the seasons follow the same progression each year, remember the importance of using a warm-up and cool-down phase each time you exercise – like nature"
- The seasons of the heart (resting = winter, warm-up = spring, work phase = summer, cool-down = fall)

Set up: Ask students to put the heart rate monitors on and check their heart rates before starting a warm-up.

Warm-up: Have a warm-up for 10 minutes to gradually raise the heart rate up to 60-70%.

Work: Complete the exercise section of the class according to the target zones. The target zone in the work phase can be 70-90%.

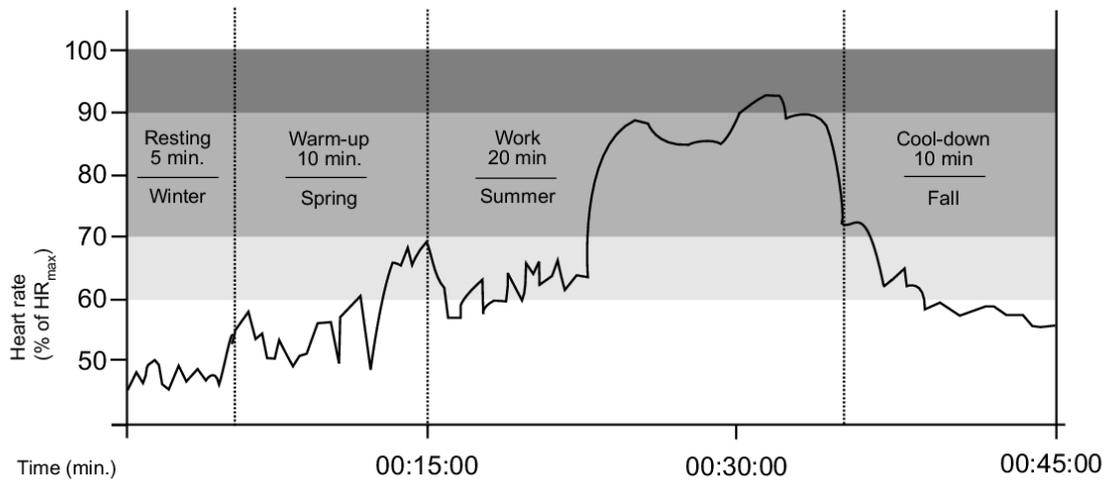
Cool-down: Once the work phase is finished, allow for gradual slowing down of the heart rate by engaging in continuous movement such as walking for several minutes. After the cool-down, ask students to stop the recording and collect the heart rate monitors for downloading the files.

Reproducible materials:

- A heart rate log
- A heart rate graph

Extension:

- Students can create their own activities for each season
- Analyze the graph with students



LESSON PLAN: CREATE YOUR OWN PE LESSON

Objective: Students will learn to create a safe PE lesson using heart rate monitors during warm-up, work and cool-down phases.

Learning points:

- To understand that exercising correctly includes warm-up, work and cool-down phases in each exercise session
- To understand which activities are suitable for different phases during the lesson

Materials: Heart rate monitors, sporting equipment depending on the sport

Key concept and activities: Divide students into three groups. One group plans activities for the warm-up phase, another group plans the work phase and a third group plans the cool-down phase. Let students show their activities to other groups. The next lesson can be planned according to students' ideas.

Method: Problem-based learning, experiential learning

Evaluation: Based on the created activities and utilizing heart rate information in exercises.

A plan for a 30-minute PE lesson:

HR%	Warm-up	Work phase	Cool-down
90-100%		<i>Make short visits to this zone and try to go near your maximum with fast sprints</i>	
70-90%		<i>Exercise mainly here - TOTAL 20 min</i>	
60-70%	<i>Start the warm-up easily - 5 min</i>		<i>Cool down to get heart rate low again - 5 minutes</i>

4.2 Lesson plans for middle and high school

LESSON PLAN: HEART RATE CIRCUIT

Objective: Students will learn how different exercises and body movements affect heart rate.

Learning points:

- To see that with different exercises it is possible to either raise or lower heart rate
- To understand that exercise engaging big muscle groups and more muscles raises heart rate
- To understand how the position affects heart rate (standing versus lying down)

Materials: Heart rate monitors, equipment for circuit spots if needed

Class duration: 45 min

Class structure:

- 5 min set-up
- 10 min warm-up
- 20 min work
- 10 min cool-down

Key concept and activities: By using heart rate monitors, students will see that heart rates are individual. They can learn how to raise or lower heart rate by choosing different exercises and movements.

Set-up: Ask students to put on their heart rate monitors and to check their heart rates before starting the warm-up.

Warm-up: Have a warm-up for 10 minutes to raise heart rate up to 60-70%.

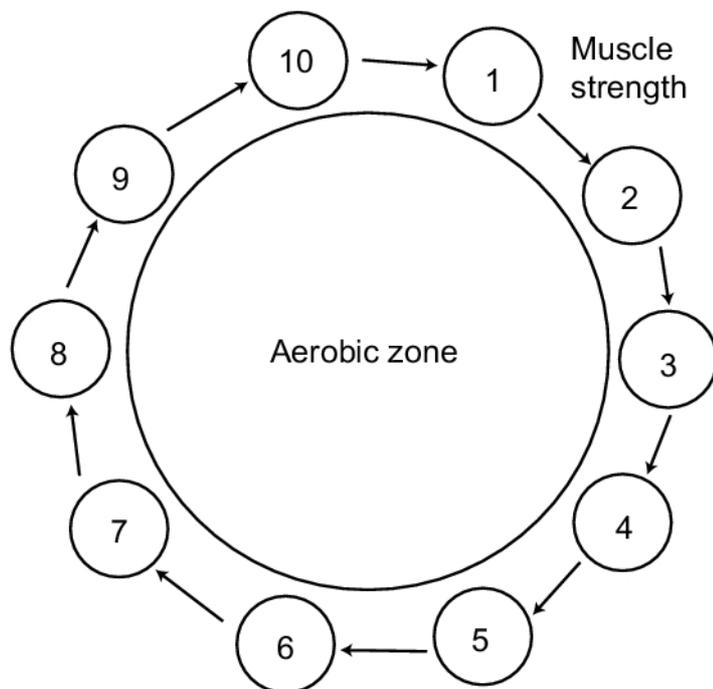
Work: Complete the circuit training according to the plan. An example of a heart rate circuit: Make two circles. The outer circle is for different muscle strength exercises, including 10 spots. Vary several muscle groups: legs, abdominals, arms and back. The inner circle is for aerobic exercises such as running in place, jumping in place, and so on. Between each strength exercise spot, there is a short aerobic session in the inner circle. You can choose to stay in each spot for one minute, and complete one full round during the 20 minutes work phase. The other option is to stay 30 seconds in each spot, and complete two full rounds. The target zones are 60-70% for strength exercises, and 70-90% for aerobic sessions.

Cool-down: Once the exercise period is finished, allow for a gradual slowing down of the heart rate by engaging in continuous movement such as walking for several minutes. After the cool-down, ask students to stop the recording and collect the heart rate monitors for downloading the files. The target zone in the cool-down phase is below 60%.

Extension: Students can create their own activities for the aerobic zone and for muscular strength spots

Reproducible materials:

- An individual heart rate course summary sheet
- A class heart rate summary sheet
- A heart rate graph from the software



LESSON PLAN: CREATE A PERSONALIZED EXERCISE SESSION

Objective: Students will learn to create safe exercise sessions using heart rate monitors during warm-up, work and cool-down phases.

Learning points:

- To understand that exercising correctly includes warm-up, work and cool-down phases in each exercise session
- To understand which heart rate zones are suitable for different phases during the session

Materials: Heart rate monitors, sporting equipment depending on the sport

Key concept and activities: Students create a 30-minute training session for themselves. The training session plan should include a goal and a phased training schedule with warm-up, work and cool-down phases. The training session can be based on three heart rate zones. Students conduct their training session by following the plan. After the training, students analyze their files.

Method: Problem-based learning, experiential learning

Evaluation: Based on the training plan and utilizing heart rate information in different phases.

Extension:

- Students can create sessions with different targets like weight management, fitness improvement, and speed improvement
- Students can create sessions for various sports to compare differences between sports

A plan for a 30-minute training session:

Main target: Fitness improvement

HR%	Warm-up	Work phase	Cool-down
90-100%		<i>Target time: 5 minutes in intervals</i>	
70-90%		<i>Target time: 15 minutes</i>	
60-70%	<i>Target time: 5 minutes</i>		<i>Target time: 5 minutes</i>

4.3 Lesson plans for adult education

LESSON PLAN: CONTINUOUS TRAINING

Objective: Students will learn that exercises and types of activities can be varied day to day or even during a workout and still maintain heart rate at a specific target heart rate zone.

Learning points:

- To be able to adjust speed and effort to stay within a target zone
- To understand that because heart rates are individual, it is each person's own responsibility to maintain the heart rate in the target zone during exercise

Materials: Heart rate monitors, equipment for aerobic training: treadmills, exercise bikes, cross-trainers and step machines

Class duration: 45 min

Class structure:

- 5 min set-up
- 10 min warm-up
- 20 min work
- 10 min cool-down

Key concept and activities: Using conditioning equipment with adjustable resistance and a heart rate monitor to document the successful personal effort, the student can follow and react to the changes in heart rate during the exercise. This way the student can easily control and adjust the exercise intensity.

Set-up: Ask students to put on their heart rate monitors and to check their heart rates before starting a warm-up

Warm-up: Have a warm-up for 10 minutes to raise the heart rate up to 60-70%

Work: Complete the work phase according to the target zone and varying aerobic equipment if possible. Ask students to try at least two different types of equipment. The target zone in the work phase is 70-90%.

Cool-down: Once the exercise period is finished, allow for a gradual slowing down of the heart rate by engaging in continuous movement for several minutes. After the cool-down, stop the recording and collect the heart rate monitors for downloading the files. Target zone in the cool-down phase is below 60%.

Tips to guide students:

- For the treadmill: Adjust the speed but keep your heart rate the same.
- For the cross-trainer: Adjust the incline but keep your heart rate the same. Don't use your arms if you want to lower your heart rate.
- For the exercise bike: Adjust your cadence to keep your heart rate the same. Adjust the resistance to stay in your target heart rate zone.

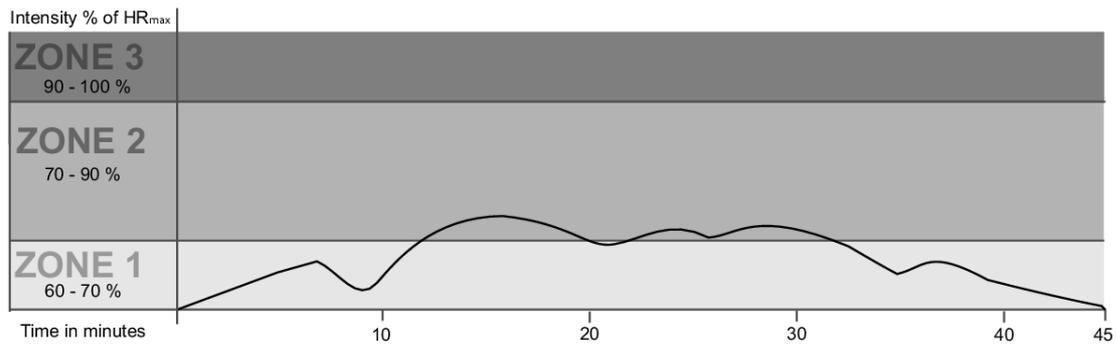
ENGLISH

Extension:

- Students can create their own activities for target heart rate zones
- Students can test staying in their target heart rate zone in different activities, such as jogging, biking and swimming. How easy is it to stay in your target heart rate zone in these activities?

Reproducible materials:

- An individual heart rate course summary sheet
- A class heart rate summary sheet
- A heart rate graph from the software



LESSONS PLAN: INTERMITTENT TRAINING

Objective: Students will learn how to change the intensity during jogging and other aerobic training.

Learning points:

- To be able to adjust speed to vary the intensity
- To understand that because heart rates are individual, it is each person's own responsibility to maintain their heart rate at a desired level during exercise

Materials: Heart rate monitors, equipment for aerobic training if the PE lesson is indoors: treadmills, exercise bikes and step machines

Class duration: 45 min

Class structure:

- 5 min set-up
- 10 min warm-up
- 20 min work
- 10 min cool-down

Key concept and activities: By using heart rate monitors, the students will learn that heart rates are individual and they can learn to adjust their heart rate by speeding up or slowing down.

Set-up: Ask students to put on their heart rate monitors and to check their heart rates before starting the warm-up.

Warm-up: Warm-up for 10 minutes to raise the heart rate up to 60-70%.

Work: Complete the interval training according to the target zones.

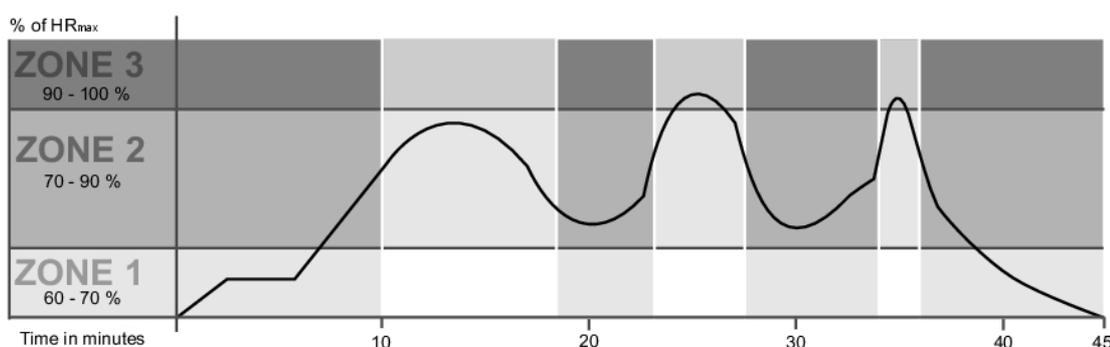
- Longer intervals: 8 min 80-90% 8 min 70-80% 5 min 80-90% 5 min 70-80% 2 min 80-90% 2 min 70-80%
- Shorter intervals: 5 min 70-80% 2 min 80-90% 5 min 70-80% 2 min 80-90% 5 min 70-80%
- Note: For some students, the recovery phase needs to be longer to be able to lower the heart rate.

Cool-down: Once the exercise period is finished, allow for a gradual slowing down of the heart rate by engaging in continuous movement for several minutes. After the cool-down, ask students to stop the recording and collect the heart rate monitors for downloading the file. The target zone in the cool-down phase is below 60%.

Extension: Students can create their own intervals and try having shorter or longer periods

Reproducible materials:

- A heart rate log
- A graph template



LESSON PLAN: CREATE A PERSONALIZED PE COURSE

Objective: Students will learn to create a training plan using heart rate monitors.

Learning points:

- To understand how to plan training sessions to create a long-term training plan.
- To understand how heart rate zones can be used in different training sessions according to the goal of the training plan

Materials: Heart rate monitors, sporting equipment depending on the sport, a six-week training plan template

Key concept and activities: Students create a personal six-week training program for themselves, and schedule in their training program plan when and how they will meet the physical activity recommendations. The training program plan should include a main goal, such as improving aerobic fitness. All training sessions should be phased and include warm-up, work and cool-down phases based on heart rate zones. The six-week training program should include aerobic training, muscle strength training and flexibility exercises. Students can also include performance goals in the program, such as balance, speed, power and agility. Students should also plan for rest and recovery in their program. Students follow their own program and after six weeks, they analyze how well they were able to follow the program.

Example: A plan for one-week training program

Main target: Fitness improvement

Method: Problem-based learning, experiential learning

Evaluation: Based on how the training program was created, how well it was followed and analysis of the training program.

Extension:

- Students can make fitness tests and create a program based on the results of the tests. After the training period, they test the fitness level again to see the difference
- Students can create a training program for their friends, their sport teams members or family members

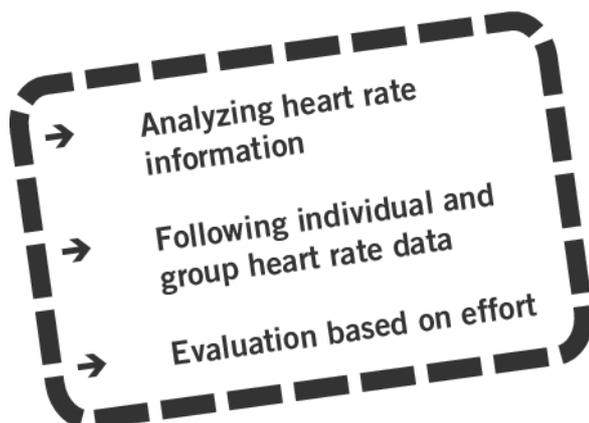
	Type of activity	Time in the target zone	HR _{avg}	HR _{max}	Duration	Calories
Monday	Planned: <i>Aerobic training: jogging</i>	Planned: <i>70-90% 45 minutes</i>	Actual: 75%	Actual: 81%	Planned: <i>60 minutes</i>	Actual: 458 kcal
	Actual: <i>Aerobic training: jogging</i>	Actual: <i>70-90% 45 minutes</i>			Actual: <i>65 minutes</i>	
Tuesday	Planned: <i>Stretching</i>	Planned: <i>Below 60%, 30 minutes</i>	Actual: 54%	Actual: 59%	Planned: <i>30 minutes</i>	Actual: 120 kcal
	Actual: <i>Stretching</i>	Actual: <i>Below 60% 30 minutes</i>			Actual: <i>30 minutes</i>	
Wednesday	Planned: <i>Recovery day</i>	Planned:	Actual:	Actual:	Planned:	Actual:
	Actual: <i>Recovery day</i>	Actual:			Actual:	
Thursday	Planned: <i>Aerobic + muscle strength</i>	Planned: <i>60-70% 20 minutes, 70-90% 30 minutes</i>	Actual: 70%	Actual: 87%	Planned: <i>60 minutes</i>	Actual: 430 kcal
	Actual: <i>Indoor cycling and gym</i>	Actual: <i>60-70% 25 minutes, 70-90% 35 minutes</i>			Actual: <i>70 minutes</i>	
Friday	Planned: <i>Stretching</i>	Planned: <i>Below 60%, 30 minutes</i>	Actual: 52%	Actual: 57%	Planned: <i>30 minutes</i>	Actual: 115 kcal
	Actual: <i>Stretching</i>	Actual: <i>Below 60% 30 minutes</i>			Actual: <i>30 minutes</i>	
Saturday	Planned: <i>Recovery day</i>	Planned:	Actual:	Actual:	Planned:	Actual:
	Actual: <i>Recovery day</i>	Actual:			Actual:	
Sunday	Planned: <i>Muscle strength</i>	Planned: <i>60-70% 30 minutes</i>	Actual: 68%	Actual: 78%	Planned: <i>45 minutes</i>	Actual: 320 kcal
	Actual: <i>Gym</i>	Actual: <i>60-70%, 30 minutes</i>			Actual: <i>45 minutes</i>	



5

ANALYZING
HEART RATE
INFORMATION

5.1 Analyzing heart rate and evaluation



PE lessons and students' performance can be analyzed with the help of heart rate information in the wrist units and in the software. There are some basic elements which can be analyzed from heart rate information, like the time spent in the target heart rate zones and average heart rate. Heart rate reports and analysis help you give a fair evaluation based on students' individual effort.

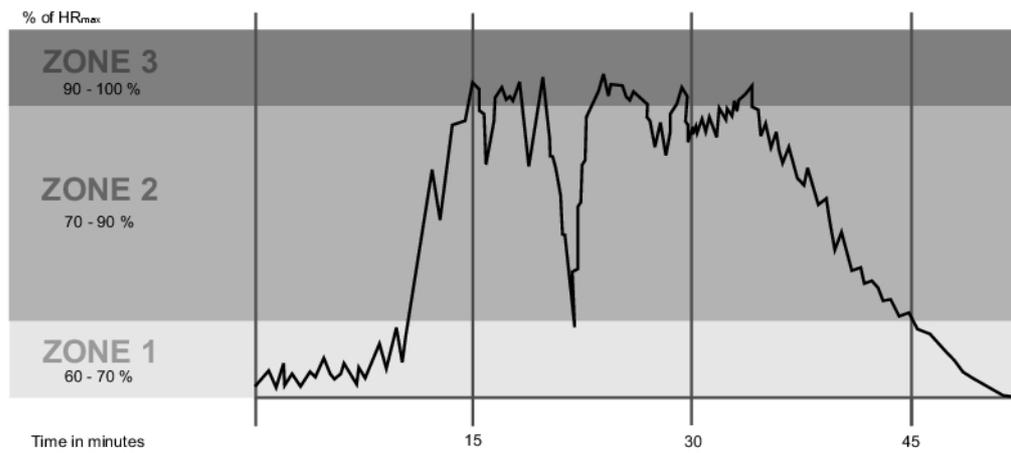
Some basic findings can be analyzed from heart rate information:

- The time spent in different target zones tells the main effect or benefit of the exercise. For example, exercising in intensity level 70-90% improves aerobic fitness. More information about the benefits of different heart rate zones is available in the heart rate zone tables in chapter 3.1.
- The average heart rate of the exercise tells about the average intensity level of the training. The average heart rate of a student during one lesson tells about the student's effort. If the student's HR_{avg} is 63%, the lesson has been less intense compared to a lesson in which student might have a HR_{avg} of 73%. Some sports are more intense than others and that can be seen in the HR_{avg} as well.
- The average heart rate can be used to analyze the student's improvement. A reduction of the heart rate to a fixed submaximal exercise is an indicator of improved aerobic fitness.
- Fit adults' resting heart rate is generally low. A lower resting heart rate might indicate an increase in aerobic fitness. Children's and adolescents' resting heart rates decrease as they get older. HR_{rest} varies too much to be used as an indicator of the fitness level.
- Fit adults recover fast, as indicated by their heart rate dropping quickly when the exercise intensity is lowered, or the exercise is stopped. A faster recovery time for adults indicates improvement in aerobic fitness. Children and adolescents have wide individual variations in recovery times, so other factors should be considered when evaluating if aerobic fitness has improved. In general, young children have fast recovery times.

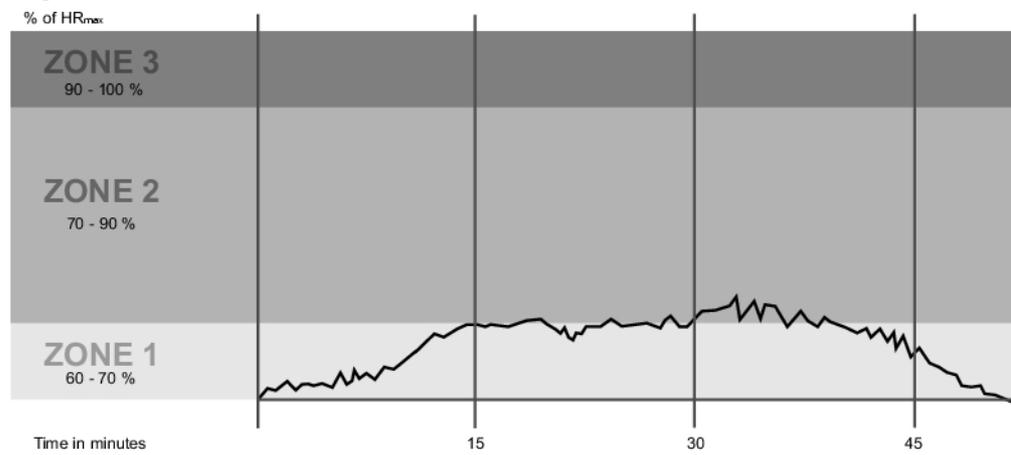
REPORTING AND ANALYZING INDIVIDUAL HEART RATE DATA

A student's heart rate data in one PE lesson can be displayed as a heart rate curve in the Polar software. During PE lessons, individual effort is measured. Depending on the target of the class and sport, the heart rate curve might look different in different PE lessons. Some sports, like ball games, are intermittent and some sports more exhausting than others. Heart rate curves can be used to teach students the differences between sports and activities and explain the meaning of cross-training.

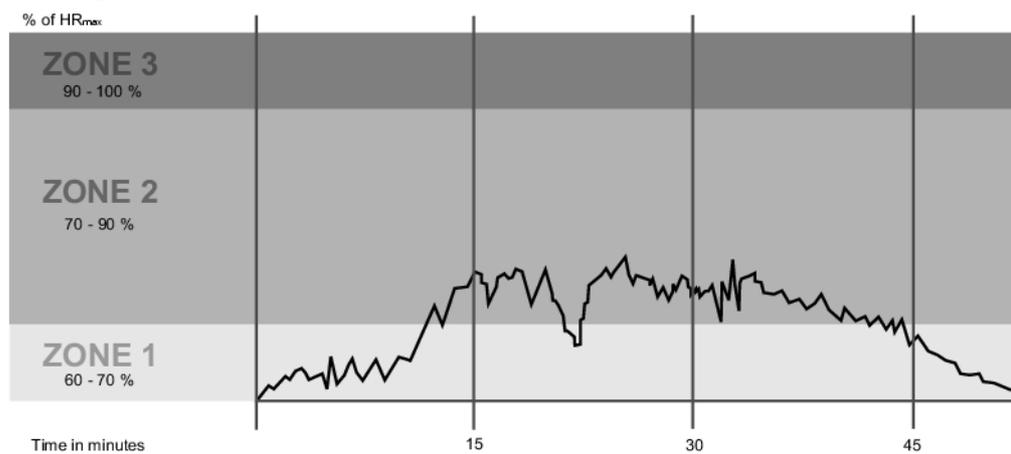
Basketball



Yoga



Dancing



Heart rate data of all the PE lessons for one student can be summarized in an individual heart rate report. The report shows the time spent in each heart rate zone, average and maximum heart rates, total duration of the training and calories. It is possible to compare the time in each heart rate zone to the target times to see how well the student has met the targets during the lessons. Individual student information can also be compared to group averages.

Name: Lisa Wilson Target zone: 70% - 90%



Date	Target time in zone	Time in zone	Average heart rate	Maximum heart rate	Calories	Comments	😊 😐 ☹️
08/16	20 min.	00:18:00	73%	90%	311	Running	😊
08/23	20 min.	00:21:00	72%	75%	350	Circuit	😊
08/30	20 min.	00:15:00	72%	84%	291	Track&Field	😊
09/06	25 min.	00:27:00	74%	82%	350	Aerobics, new target time!	😊
09/13	25 min.	00:20:00	74%	90%	413	Basketball	😊

REPORTING AND ANALYZING GROUP HEART RATE DATA

In addition to students' individual data, it is possible to analyze the summary data of the class. This helps in evaluating how well the PE lesson was planned and if the targets were achievable. Class reports summarize the heart rate data of students from one class. The class reports show group averages and every students' time spent in each heart rate zone, their average and maximum heart rates, the total duration of the training and calories burned. The group averages can be compared between different classes.

Class summary comparison:

- Check how much time students have spent in the target zone(s)
- Analyze your PE lesson's structure
 - » Avoid lines and create alternative activities for waiting times. Add more equipment and vary exercising areas to increase the students' activity and intensity
- Compare different groups following the same course outline
- Compare average heart rate information
- Compare maximum heart rate information

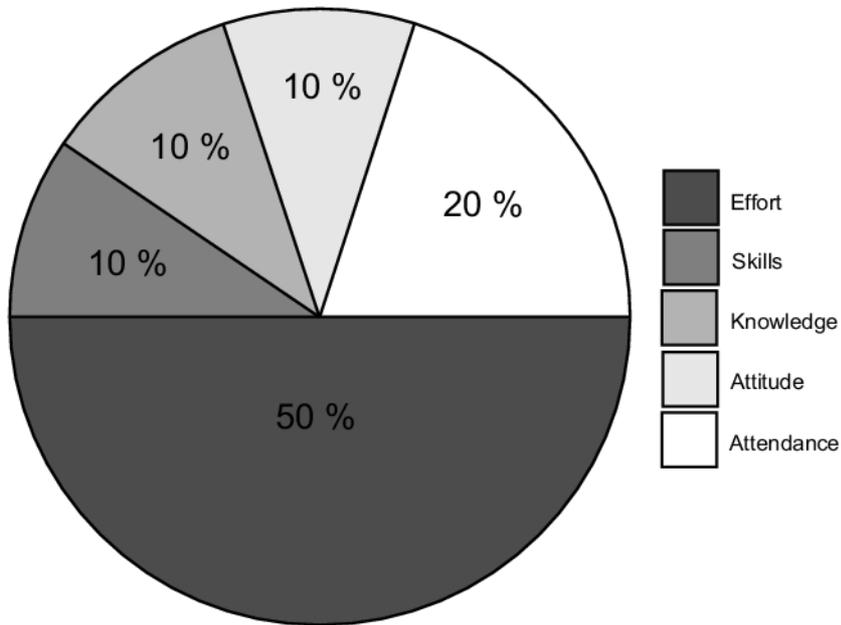
Date: 08/16 Target zone: 70% - 90%



Name	Target time in zone	Time in zone	Average heart rate	Maximum heart rate	Calories	Comments
Brenda	20 min.	00:20:00	71%	85%		Sport: circuit
Charles	20 min.	00:19:00	74%	86%		
Samuel	20 min.	00:25:30	79%	93%		Very active!
Sarah	20 min.	00:05:00	58%	74%		Attitude!
Jack	20 min.	00:18:30	73%	90%		Good improvement

EVALUATING STUDENTS BASED ON EFFORT

The main idea behind the evaluation is that you as a teacher do not give grades, but instead, the students earn them. With heart rate monitors, you can evaluate the effort, not just skills. Heart rate monitors give accurate information about every student, and show if students are doing their best in every lesson. This way students receive credit for what they do. Here is one example of a PE assessment:



5.2 Testing cardiovascular fitness with heart rate monitors



WHY TEST CARDIOVASCULAR FITNESS?

The main idea of cardiovascular fitness testing is to get information about a person's physical condition and to see the person's fitness level. Test results can be compared to population norms, the average values of people of the same age and gender. Fitness testing motivates and inspires a person to exercise. The tests are most useful when following individual progress by comparing new results to previous ones in order to see the improvement in cardiovascular (aerobic) fitness. Fitness tests are the cornerstone of personal training. When a person knows the test result, it is easier to choose the right target heart rate zones. To be able to follow the progress, the test should always be carried out under the same conditions, meaning for example always performing the same fitness test procedure at the same time of the day.

There are numerous fitness tests to test aerobic fitness, ranging from sophisticated laboratory tests to simple field tests. They are all designed to measure or predict oxygen uptake (maximal aerobic power, VO_{2max}). Most predictive tests target to estimate the oxygen uptake of the body via heart rate and/or workload. It is very important to choose the right test for the specific target group. Athletes have different tests compared to fitness exercisers, and children have different tests than adults.

HOW SOON CAN THE IMPROVEMENT IN FITNESS BE SEEN?

For adults, it takes a minimum of six weeks on average to achieve a noticeable change in cardiovascular fitness. Less fit individuals see progress even more rapidly. For more active individuals more time is needed. An average change in cardiovascular fitness for adults is 12-15% in 10-12 weeks if moderate intensity exercise is performed 3-4 times a week for at least 30-40 min each time.

Children's and adolescents' fitness level do not change as easily as adults'. There are a number of factors influencing the degree in which the VO_{2max} of children and adolescents improves as a result of aerobic training. These factors include for example the volume of training, age and maturation, VO_{2max} prior to training, habitual physical activity and genetics. In general, males have higher VO_{2max} values compared to females of the same age. Training seems to affect both aerobic and muscular fitness levels of children and adolescents, although there are several other factors affecting the fitness levels. An average change in the VO_{2max} of children is likely to be a minimum increase of 6-10% after a 12-week training program. The training program should include a mix of continuous and interval training using large muscle groups, performed 3-4 times per week for 40-60 minutes per session at an intensity level of 85-90% of HR_{max} . [8]

FOLLOWING PROGRESS WITH AVERAGE HEART RATE

Record average heart rate at a constant workload performance of, for example, 10-15 minutes. If you are using fitness equipment like a treadmill, an exercise bike or a rowing machine, a certain load (resistance) can be set. When you get fitter, the average heart rate drops in constant performance. Another option to follow the progress is to measure the workload (e.g power output) at a certain fixed heart rate, for example

85%, and follow how the workload has increased compared to an earlier training session. If you do not have access to such equipment, it is possible to run on an outdoor track for a certain length of time instead. As a person gets fitter over time, the average heart rate gets lower with the same workload. Correspondingly, speed increases and the distance covered by walking or running in a certain time increases at a certain heart rate. Average heart rate tests can be done for example once a month, or at least once every four months to follow the improvement.

ONE MILE-RUN TEST WITH A HEART RATE MONITOR

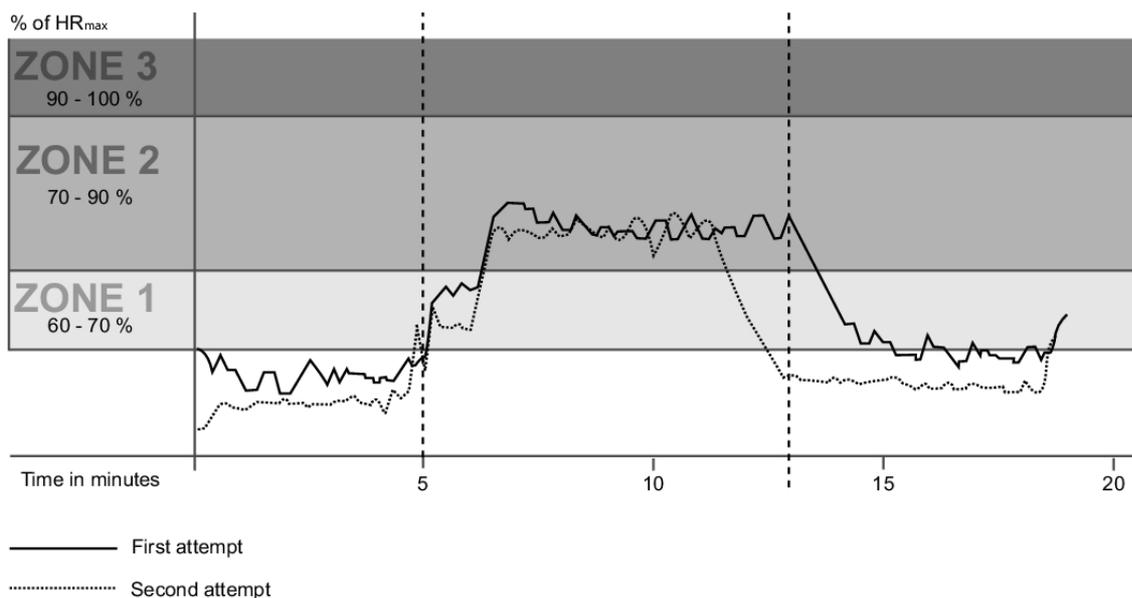
Cardiovascular fitness tests can be greatly enhanced with the help of heart rate information. In addition to time or distance, heart rate monitors give important information, such as pre-test heart rate, testing heart rate and recovery heart rate. A printed heart rate curve shows visual evidence of heart rate throughout the test.

A one mile-run test with a heart rate monitor gives not only the mile time, but also valuable information on heart rate. The test can also be at a sub-maximal level by using heart rate limits encouraging students to stay below 90% of their maximum heart rate.

1. Before the test, have students rest to get their pre-test heart rates.
2. Ask students to run at a pre-determined heart rate zone, for example 85-90%.
3. After the test, students record their recovery heart rates and time.
4. Analyze the graphs with students by comparing their results to previous test results to give them visual evidence on their mile-run test.

With the same guidelines, it is possible to have the students perform a 12-minute running test with heart rate monitors. If needed, adjust the target heart rate zone into the sub-maximal level and ask students to run for 12 minutes. The distance is measured and a heart rate curve with recovery information can be analyzed after the run.

Note: There are several factors affecting heart rate, so the analysis should be done carefully and all the factors should be taken into account. The maturity of children affects heart rate and this should be noted when evaluating the results, especially if comparing the results with other students' results.

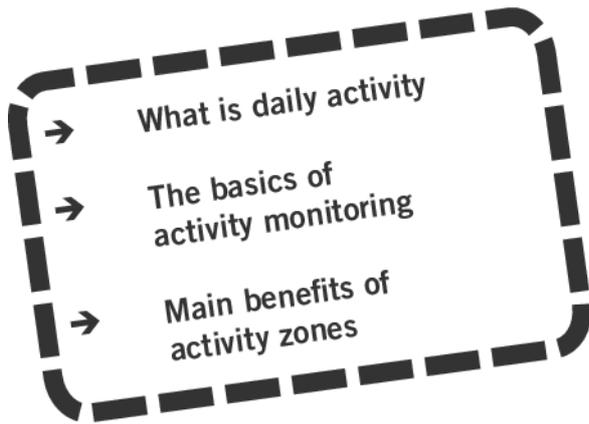




6

USING ACTIVITY MONITORS IN SCHOOL

6.1 Monitoring daily activity



WHAT IS DAILY ACTIVITY?

Daily physical activity can be a part of everyday life in various ways. It can occur in several short sessions throughout the day. The amount of daily activity depends on the choices made during the day, like walking up the stairs instead of using the elevator, or walking to school instead of taking a bus.

FACTORS AFFECTING DAILY ACTIVITY

There are several ways to add physical activity to everyday life.

At home:

- Doing housework, like vacuuming
- Walking the dog
- Walking to shops
- Playing outside
- Combining exercising with other activities, for example stretching while watching TV

At school / office:

- Walking up the stairs instead of using an elevator
- Walking a longer route
- Playing at recess
- Getting off the bus a few stops early and walking the rest of the way

At play / recreation:

- Enjoying recreational outdoor activities like backpacking
- Exercising with friends
- Playing with the whole family
- Choosing video games that require movement

WHY IS IT IMPORTANT TO MEASURE DAILY ACTIVITY?

An activity monitor tells in a simple way if you are active enough during the day. It reminds and motivates towards a healthier lifestyle. An activity monitor also gives objective evidence on physical activity and brings many benefits to all students.

Benefits related to learning about having an active lifestyle:	Benefits related to learning about exercising:	Benefits related to monitoring progress:
<ul style="list-style-type: none"> Teaches about the amount of daily activity needed for health effects All activity, such as running, jumping, throwing, swimming, and playing is counted and measured Provides instant visual feedback on daily activity 	<ul style="list-style-type: none"> Teaches about different levels of activity by tracking the quantity and quality of daily activity Tracks all activity which affects the total workload Tracks the number of steps and calories burned 	<ul style="list-style-type: none"> Offers a possibility to follow activity in the activity monitor's activity diary Provides information about lower activity levels and sleeping time which helps to balance rest and activity

HOW TO MEASURE DAILY ACTIVITY?

An easy way to measure daily activity is to wear an activity monitor on the wrist. The activity monitor measures activity during the day and rewards the user when activity targets are fulfilled. In general, it is easy to remember and report time spent doing exercise such as jogging, but difficult to remember everyday activities or time used for sedentary activities like sitting. People tend to overestimate their daily activity, and therefore an objective measurement of daily activity is eye-opening.

Activity monitors give instant feedback about the activity level; an animated figure on the wrist unit shows the activity level and the activity bar displays the active time accumulated throughout the day. The active time includes the time in moderate to vigorous+ activity levels. The active time excludes the time standing, sitting or sleeping. Activity monitors show the intensity and active time in five activity zones - very easy, easy, moderate, vigorous, and vigorous+. An activity monitor also measures the calories and the number of steps taken during the day.

To gain health benefits, the most important thing is to be physically active every day. The quality (intensity) and quantity (duration) of the activity are the key factors. For fitness improvement, even a few sessions per week bring health benefits, but in this case, the intensity and selecting the right activity zone becomes more important. The right intensity or activity zone depends on the fitness level. The better the fitness, the higher the intensity can be. Fit students can exercise in the highest zone at times to improve performance, but for unfit students, moderate and vigorous zones are enough to improve fitness.

ACTIVITY TERMINOLOGY

MVPA: MVPA is the abbreviation for moderate to vigorous physical activity. The activity monitor also separates the vigorous+ activity zone for very intense activities. The physical activity recommendations advise to be active at these intensities at least an hour per day to gain health and fitness benefits.

MET: MET stands for metabolic equivalent and it expresses the intensity and energy expenditure of physical activities. METs are multiples of resting metabolic rate (RMR), meaning that 1 MET=RMR. MET values of physical activities range from <1 (sleeping) up to 20 (fast running). In the Polar Active activity monitor the activity zones are calculated based on MET values, meaning that very easy is 1-2 MET, easy is 2-3.5 MET, moderate is 3.5-5 MET, vigorous is 5-8 MET and vigorous+ is >8 MET. The active time is calculated from activities above 3.5 MET.

Calories: The activity monitor displays the total daily energy expenditure in kilocalories. The total daily energy expenditure is the sum of estimated energy expenditure while awake plus estimated night time energy expenditure. Energy expenditure depends on personal information such as age, gender, height, and

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weight. The total energy expenditure is approximately 2000-2300 kcal/day for 8-12 year-old boys and 1600-1900 kcal/day for 8-12 year-old girls. For 5-8 year-old children, the energy expenditure is about 1300-2000 kcal/day. Calories burned during the exercise depend on personal factors, type of activity, duration and intensity of activity. [9]

Steps: The activity monitor counts the number of steps taken based on movement and the rhythm of the movement. The steps of all activities are counted. There are many recommendations regarding the number of steps per day. An approximate need for 6-12 year-old girls is 12, 000 steps/day and for boys 15, 000 steps/day to stay in a healthy body mass index range. [10] For adults, the rule of thumb is to get 10, 000 steps/day. The number of steps alone is not enough to evaluate the amount of daily activity, and therefore, the time spent in moderate to vigorous+ activity zones should be monitored as well.

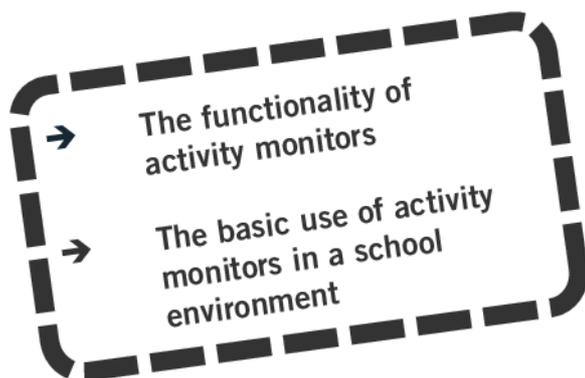
ACTIVITY ZONES

Activity zones are based on MET values. The following chart displays the activity zones and their benefits on health and fitness:

Daily activity recommendation for children and adolescents:

Zone:	Example activities:	Recommendation:	Benefits:
Vigorous +	Fast running		Improves maximum performance and cardiovascular fitness Helps improve speed
Vigorous	Basketball, soccer, inline skating, rope jumping, dancing	The total time at vigorous+, vigorous and moderate intensities: 1 hour minimum per day, 2 hours are recommended	Improves cardiovascular endurance Promotes bone health Helps increase power
Moderate	Playground games, gymnastics		Helps maintain a healthy body weight Helps increase flexibility
Easy	Playing catch, slow walking, stretching	It is better to get up and move than sit still	
Very easy	Playing video games, watching TV	Time used for sedentary, passive activities such as TV, and computers should be kept as low as possible	
Sleeping		For 5-12 year-old 9-11 hours, for adolescent 9-10 hours	Gives your body a rest Improves learning ability

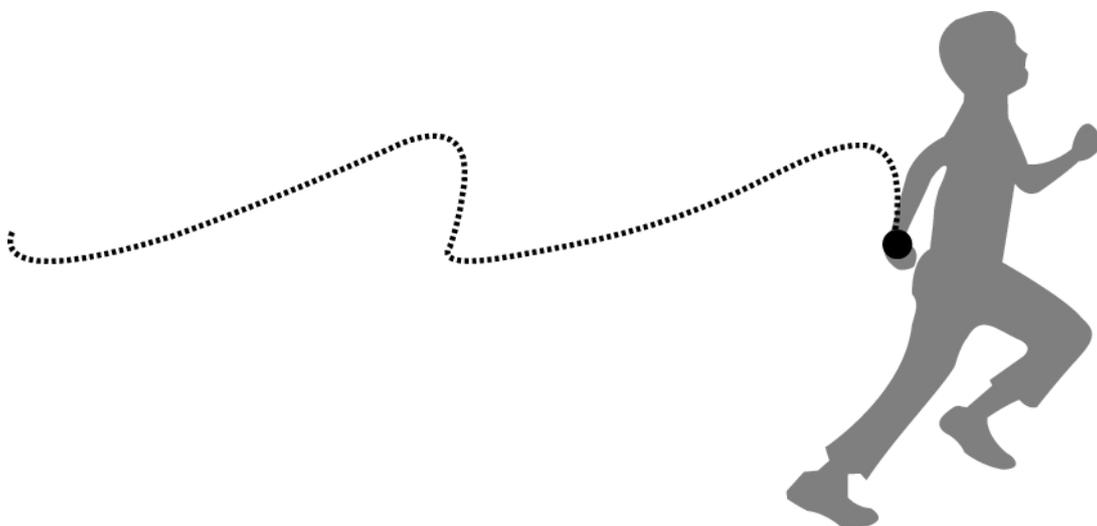
6.2 Practical guidelines for measuring daily activity



Activity monitoring is based on body movement which is measured by a built-in accelerometer in the activity monitor. It is simple for the teacher because the wrist unit is all the students need to wear to measure their daily activity. An activity monitor can be used just like a watch on the wrist and it's comfortable to wear all day and night.

HOW DO ACTIVITY MONITORS WORK?

An activity monitor is easy to use: just wear the activity monitor and go. There is no need to attach a transmitter strap or separate sensors. During action, an activity figure shows the intensity of activity visually, for example, the figure is running. In the Polar activity monitoring, the source of information is body activity and the information is based on acceleration measurement. The acceleration signals are filtered and interpreted as MET's, steps, and kilocalories.



THE BASIC FEATURES OF A GOOD ACTIVITY MONITOR

Activity monitors display the following activity information:

- The total active time (MVPA)
- The time spent in the different activity zones
- The number of steps
- The cumulative calories (kcal)

PRACTICAL ARRANGEMENTS IN SCHOOL AND AT HOME

Equipment:

- Activity monitors for each student
 - » If you have several products, identify the monitors for students. You can label products either in the web service or just add numbers with stickers to the products.
- A management system for activity monitors
 - » If you have several management systems, add letters to the cases to recognize them.
- Following students' activity data
 - » You can download the activity data from the activity monitors to the web service for further analysis, or you can use the printed posters or activity diaries to save the activity data and add it to students' portfolios.

Instructions for students:

1. Wear the activity monitors
2. Insert your personal information into the wrist unit
3. Get active to fill up your activity bar
4. Check your activity information in the activity monitor's diary and follow your activity level

Questions to discuss with the students:

- How did you get the activity bar filled?
- How did you get time for each activity zone?

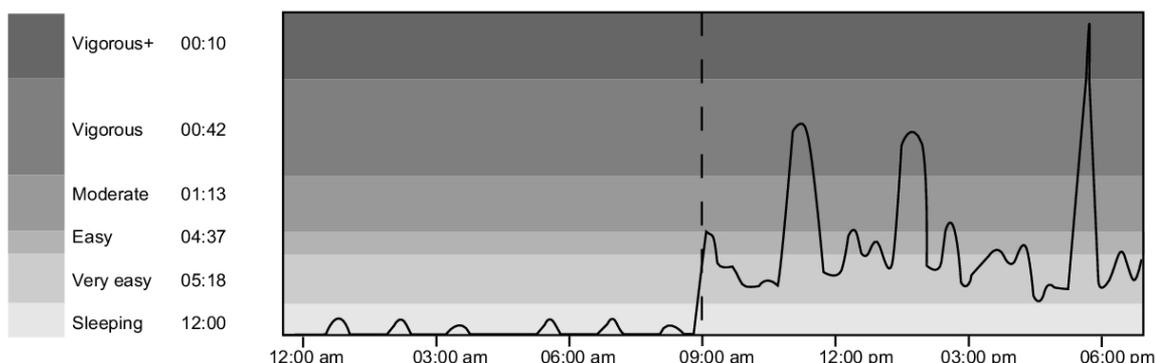
6.3 Active school day



STRUCTURE OF AN ACTIVE DAY

Daily activity can be collected throughout the day. Physical activity can be increased very easily by changing daily routines. Below is a structure for an active day for students and some examples on how to be physically active during the day. Activity during the day can also be expressed as a curve.

Morning	School day	Afternoon	Evening	Night
Get fresh air before sitting in a class room. Walk to school instead of taking a bus.	It's better to get up and move than sit still. During recess, choose jump ropes, hopscotch, running.	You can sit at school, otherwise get up! After doing your homework, go out and play with your friends.	Be active more than one hour every day! Enjoy sports, but remember to rest before going to bed.	9 hours of sleep every night keeps your mind fresh!



HOW TO ADD ACTIVITY IN SCHOOL?

An active school encourages students to be active for at least 60 minutes a day. Any activity can be a part of an active school day. Depending on the school level and the students' needs, school days can include teaching basic movement skills such as running, jumping, throwing and catching a ball, but also higher level skills such as overall wellbeing and creating training programs. You and older students can be good role models for younger students on leading a healthy lifestyle.

In active schools, all provided activities should be based on the students' interests, needs and abilities. Physical activities should be increased by reducing sedentary time and increasing fun and inspiring recess activities. The school environment should provide opportunities and facilities to be active. Active schools give lifelong lessons on how to be active and healthy by also involving parents and the community in an active lifestyle.

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School settings play an important role in the active school model. Involving students to plan the school environment can spark their interest to participate in activities during recesses and also after school. The school environment should be motivating both outdoors and indoors. The structure of a school day should be created to support daily activities, meaning that there are enough breaks and possibilities to be active between classes. Integrating physical activity to other subjects like biology, math or health education is one option to add daily activity in school.

Different campaigns are a great way to motivate students to be more active. With campaigns, it is easier to raise interest and also get parents involved in promoting daily activity. There are several ways to promote an active lifestyle, for example focus days, focus weeks and challenges.

FOCUS DAYS

Very common and widely known focus days are "Walk to school day" or "Bike to school day". Here you can see an example of Fit Friday which can include any kind of inspiring activities for the entire school.

Fit Friday

Theme of the day: Fit Friday with tricks - learning motor skills

Reproducible materials: Create your own promotional material about activities offered during the day

Morning activity tip	School day activity tip	Afternoon activity tip	Evening activity tip
<i>Advise students to walk to school with their classmates instead of taking the bus.</i>	<p><i>Recess activities</i></p> <p><i>"Good morning" gymnastics organized outdoors for both students and teachers</i></p> <p><i>"Trick track" during recess. Create a track with different exercise stations around the school yard. Each station focuses on motor skills and offers tricks for students at different skill levels. These may include jumps, throwing and so on.</i></p>	<i>Encourage students to practice the tricks they learned at school at home and urge them to show the best trick set to their parents.</i>	<i>Tip off your students to put on some music and have a Friday night dance in their livingroom with their friends and siblings.</i>

FOCUS WEEKS

Focus weeks give even more possibilities to give practical examples of active everyday living for your students. During the week, you can focus on separate themes like exercising, nutrition and resting. Here you can see some examples on how to organize a focus week.

Wellness week

Theme of the week: Wellness week - learning healthy habits

Reproducible materials: Create your own promotional material about activities offered during the week

	Theme	Target	Morning activity tip	School day activity tip	Afternoon activity tip	Evening activity tip
Monday	<i>Move more Monday</i>	<i>Be active for more than 2 hours today</i>	<i>Wake-up stretching</i>	<i>Keep your activity figure moving during recess</i>	<i>Create jump rope tricks</i>	<i>Make your own evening exercise - choose what you like</i>
Tuesday	<i>Team Tuesday</i>	<i>Challenge the whole school to collect xxx hours of active time (calculated for example 1,5 hours per person)</i>	<i>Early morning soccer game</i>	<i>Create recess activities for the whole class</i>	<i>Walk back home with students from your neighborhood</i>	<i>Challenge your family members to collect active time with you</i>
Wednesday	<i>Walking Wednesday</i>	<i>Collect 15 000 steps</i>	<i>Walk to school</i>	<i>Jump rope challenges during recess</i>	<i>Walk back home a longer way than usually</i>	<i>Stretch while watching TV</i>
Thursday	<i>Tasty Thursday</i>	<i>Balance calories - eat well and be active to keep the energy level balanced</i>	<i>Full grain for breakfast</i>	<i>Lunch break news - information about healthy food choices</i>	<i>Choose a healthy snack - fruits and vegetables</i>	<i>Collect active time to get your calories balanced</i>
Friday	<i>Fit Friday</i>	<i>Be active more than 2 hours today</i>	<i>Walk to school</i>	<i>"Trick track" during recess including jumps, running, throwing</i>	<i>Practice the tricks you learned at school also at home and show the best trick set to your parents</i> <i>Get some fresh air by walking to a park</i>	<i>Put some music on, and do some Friday night disco dancing in your livingroom</i>

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CHALLENGES

There are numerous ways to organize challenges in schools. It is possible to compete in the active time collected or steps collected. It is a good idea to compete as a group, for example, by having challenges between classes or challenges between students and teachers. It is also possible to challenge the parents to get them involved in the activity projects. You can also challenge another school, even from another part of the world.

AFTER SCHOOL ACTIVITIES

After school activities are an option to offer extended exercise and playing possibilities for those students who are not part of any sports clubs. Cooperation with local sport organizations and clubs, and with communities like parental homes and day care centers might offer new aspects to daily activities. Involve parents in physical activities offered by the school.



7

IMPLEMENTING ACTIVITY MONITORING IN SCHOOL

7.1 Lesson plans for elementary school

LESSON PLAN: CIRCUS CIRCUIT

Objective: Students will learn to be active enough during the whole PE class.

Learning points:

- To understand the importance of individual effort during a PE class
- To understand that many different activities accumulate active time at moderate and/or vigorous intensities

Materials: Activity monitors

Class duration: 45 min

Class structure:

- 5 min set-up, if students are not already wearing activity monitors
- 5 min warm-up
- 30 min work
- 5 min cool-down

Key concept and activities: Different exercise stations and trick spots are located in the gym area. Students move independently from station to station. In the middle of the gym, there is a resting station where students can recover when needed. The goal is to get 30 minutes of active time recorded.

Set-up: Ask students to put on the activity monitors and add basic settings if needed.

Warm-up: Students do the first round of tricks under your guidance. The focus is that students see different tricks and choices which they then choose according to their own skill level.

Work: Tricks and movements focusing on different motor skills in exercise stations. Students can go to the resting area whenever needed. However, the target is to get the activity target time fulfilled during the class.

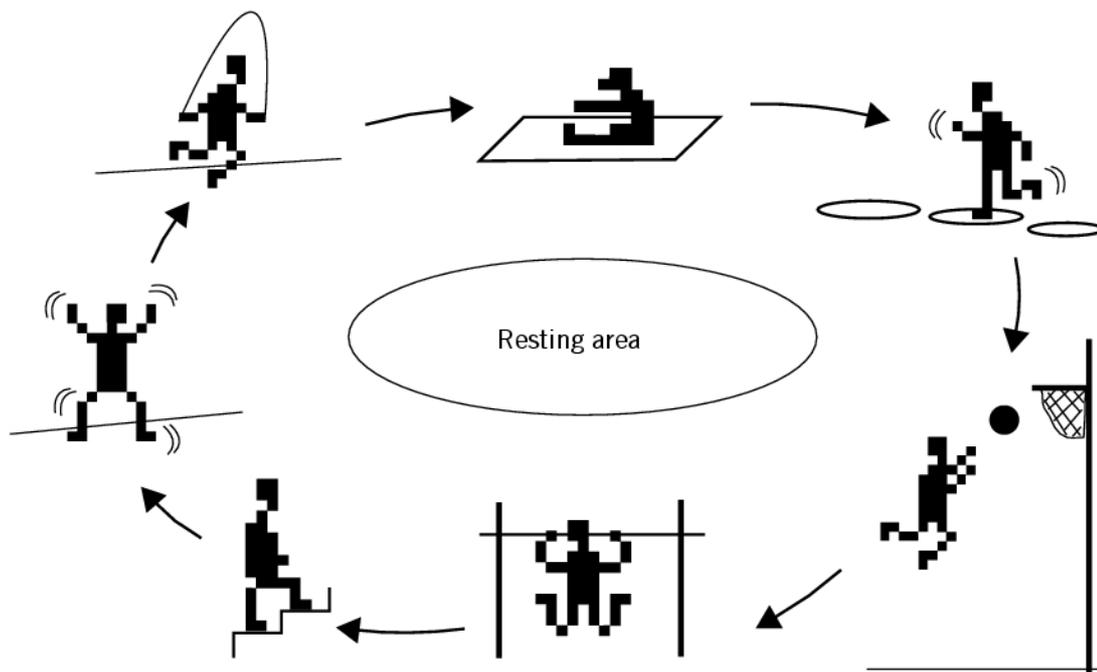
Cool-down: Resting and stretching in the resting area. Different relaxation exercises recommended in sitting and standing positions in order to see the activity figure sitting and standing on the monitor.

Reproducible materials:

- An activity progress poster
- An individual daily activity log
- A class daily activity log

Extension:

- Students can create their own activities for each station
- Students can create their own relaxation exercises for the resting area
- Check the activity file with students to see the time spent in each zone



ACTIVITY PERIOD PLAN: DAILY ACTIVITY LOG

Objective: Students learn to make active choices in their everyday life

Learning points:

- To plan and follow daily activity
- To understand how to add daily activity to everyday life

Materials: Activity monitors, daily activity diary, and individual daily activity log

Key concept and activities: Students follow daily activity for one day and collect the information in the activity diary sheet. Activity information is analyzed as a group. Students make a plan for one active day and try to follow that plan. Then they analyze the active day and compare it to information from a previous day.

Method: Problem-based learning, experiential learning

Evaluation: Based on the active time collected and analysis of the student's own activity period

A plan for an active day:

	Morning	School day	Afternoon	Evening
Planned	<i>Walking to school, 20 minutes</i>	<i>Recess playing, total of 15 minutes</i>	<i>Playing in the park, total of 60 minutes</i>	<i>Playing soccer, total of 60 minutes</i>
Actual	<i>Walking to school, 20 minutes</i>	<i>Recess playing, total of 25 minutes</i>	<i>Playing in the park, total of 30 minutes</i>	<i>Playing soccer, total of 75 minutes</i>

7.2 Lesson plans for middle and high school

LESSON PLAN: ACTIVITY ZONE DEMONSTRATION

Objective: Students will learn to be active in different activity levels.

Learning points:

- To understand how different activity levels feel
- To learn ways to be active in different activity levels

Materials: Activity monitors, activity progress poster, and tape to mark the activity zones in the gym

Class duration: 45 min

Class structure:

- 5 min set-up, if students are not wearing activity monitors
- 5 min warm-up
- 30 min work
- 5 min cool-down

Key concepts and activities: Sleeping area and five activity zones (very easy, easy, moderate, vigorous, and vigorous+) are marked in a line in the gym, starting with the sleeping area on the left side. Students make six groups and each group goes to one activity zone area. In each activity zone, there are 2-3 different activities to choose from. The activities represent the corresponding activity zone, meaning that the sleeping area is for resting, the very easy zone is for sitting type of activity, easy is for standing type of activity, moderate is walking type of activity, vigorous is running type of activity, and vigorous+ is fast running and/or jumping type of activity. Groups stay in each zone for two minutes and then move on to the next zone. From the vigorous+ zone the group goes to the sleeping area. Otherwise groups always move on to the next more intense zone. The target is to get a minimum of 15 minutes active time to the activity bar. After the lesson, students mark their active time on the activity progress poster on the wall or in their own printed activity logs.

NOTE: You can also advise students to try to make easy zones more intense, and this way collect even more active time to the wrist unit.

Set-up: Ask students to put on the activity monitors and add basic settings if needed.

Warm-up: You should demonstrate the activities in each zone from very easy to vigorous+. All the activities are done in place, so students stay in their designated spaces. Activities may include sitting type of activities like sit-ups, different activities when standing like squats, and for example walking, running and different jumps on the spot.

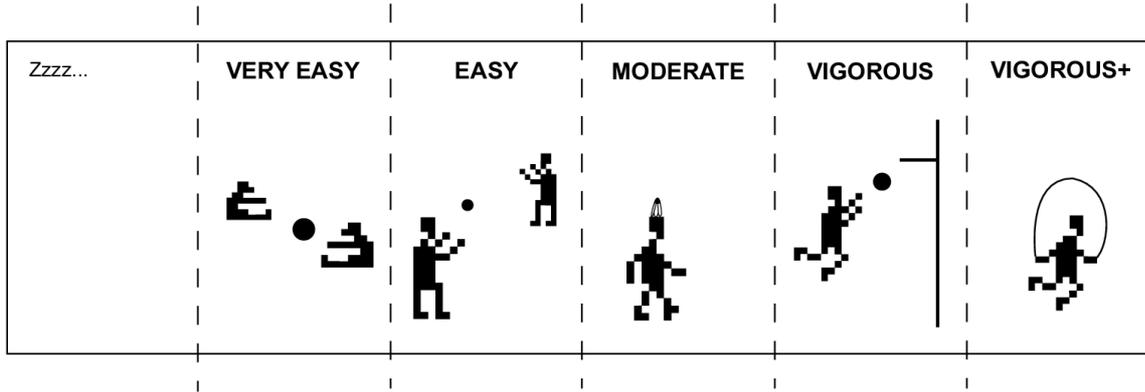
Work: Groups move from a zone to zone, rotating every two minutes until all zones have been visited twice.

Cool-down: For cool-down, students can walk in place in the moderate activity zone for two minutes, then stop and stretch standing and finally stretch in a seated position. In the end, students remain resting on the floor for one minute. After this, they mark their accumulated active time on the activity progress poster and color the bars accordingly.

Reproducible materials: A daily activity diary

Extensions:

- Students can create their own activities for each activity zone
- Check the activity file together with the students to see the time spent in each zone



ACTIVITY PERIOD PLAN: ACTIVE WEEK

Objective: Students learn to make active choices in their everyday life, and create weekly activity plans including different MVPA activities.

Learning points:

- To understand the difference between daily activity and a planned exercise session
- To understand the meaning of MVPA in a weekly plan

Materials: activity monitors, activity progress sheet, and plan for an active week

Key concept and activities: Students follow their daily activity for one week and collect the information in the Activity progress sheet. Students analyze the information, specify their key findings, and based on the findings, they create a plan to increase their daily activity. Students make a plan for one active week including daily activities and exercising at moderate to vigorous+ activity zones and try to follow that plan. Then students analyze the active week and compare it to the information of an earlier week.

NOTE: If the activity was done in moderate to vigorous+ activity zones, remember to mark it with MVPA

Method: Problem-based learning, experiential learning

Evaluation: Based on the active time collected and analysis of the student's own activity period

7.3 Lesson plans for adult education

LESSON PLAN: CREATE YOUR OWN ACTIVITY SESSION

Objective: Students will learn to be active in moderate to vigorous+ activity zones and modify the intensity during the activity session.

Learning points:

- To understand the difference between moderate and vigorous+ activity zones
- To modify the type of activity to be able to change the activity zone

Materials: Activity monitors, activity progress poster

Class duration: 45 min

Class structure:

- 5 min set-up, if students are not wearing activity monitors
- 5 min warm-up
- 30 minutes work
- 5 min cool-down

Key concept and activities: Students create their own activity sessions to get the activity bars in their wrist units filled up. Students can choose either walking, jogging or running or they can do interval type of training by combining all of these. The activity session should be done on a track. The target is to get a minimum of 30 minutes of active time.

Set-up: Ask students to put on the activity monitors and add the basic settings if needed.

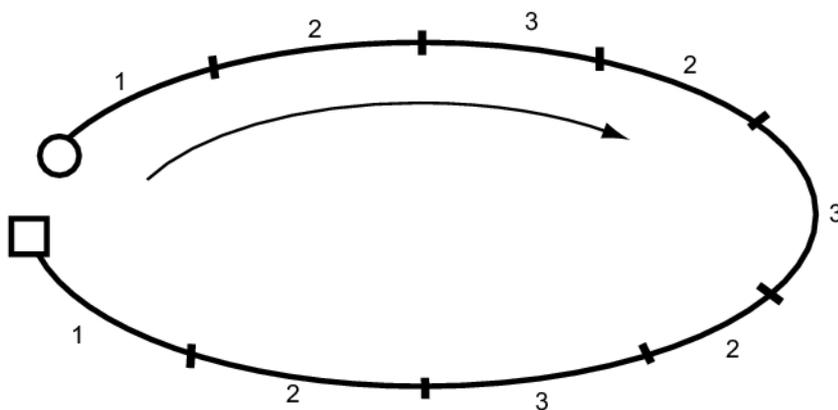
Warm-up: All students start their route by walking slowly for the first 5 minutes.

Work: During the route, students follow their session plan and variate between walking (1), jogging (2) and running (3). They can also include some muscle strength exercises between the walking/jogging/running phases.

Cool-down: All students walk the last 5 minutes of the route.

Reproducible materials: A daily activity diary to be used for one activity session

Extension: If there are several training facilities nearby, students can also try different types of exercises, and find out the best way to collect active time in their activity monitors. Students write down their favorite activities and compare the different activities to see if those are classified as moderate, vigorous or vigorous+ activity zones.



ACTIVITY PERIOD PLAN: ACTIVE WEEK CAMPAIGN

Objective: Students learn to create focus days and plan an active week campaign for the whole school

Learning points:

- To understand the different ways to be active during the week
- To motivate others to be active and show a good active example for others

Materials: Activity monitors, daily activity diary, activity progress sheet and a plan for individual active week

Key concept and activities: Students follow their daily activity for one week and collect the information in the activity progress sheet. Students analyze the information, specify their key findings, and based on the findings, they create a personal plan to increase their daily activity. Students follow the weekly plan and analyze the information by comparing it to the previous week's data. After the week, students make five groups and each group creates a focus day for the whole school. The focus day plan should include a theme and target for the day, practical activity tips and some recess activities organized by the students themselves. Students can utilize their best practices to collect active time from their personal plans and include the best examples into the focus day plan. The focus day plans are put together, and are used as a weekly plan for the whole school. After the focus week, students analyze their activity information and compare it to the information from the earlier two weeks.

Note: Focus days can be organized one day per week, this way it is possible to have the focus days for a longer period. If there are several classes involved, it is possible to have one focus day each week during the entire school year.

Method: Problem-based learning, experiential learning

Evaluation: Based on the active time collected, analysis on the student's own activity periods and planning and implementing a focus day.

Plan for a focus day or a week:

Theme and target of the day: Specify the theme and target

Reproducible materials: Create your own promotional material about activities offered during the day

Morning activity tip	School day activity tip	Afternoon activity tip	Evening activity tip
<i>Create morning activities suitable for everyone</i>	<i>Create motivating recess activities for students and teachers</i>	<i>Create activities to be organized after school for students and teachers</i>	<i>Give tips for evening activities or create activities for the whole community to take part in</i>



8

ANALYZING
ACTIVITY
INFORMATION

8.1 Analyzing daily activity and evaluation



Daily activity analysis should be based on the physical activity recommendations such as the American college of Sports Medicine physical activity recommendation or national physical activity recommendations. You can analyze students' activity information from the wrist unit, use reports which are available on the web service or use printed paper reports. In the wrist unit and in the student's individual report, there is a lot of information to be analyzed and used as a part of an evaluation. This way you can base the evaluation on effort, not just skills.

HOW TO ANALYZE INDIVIDUAL DATA FROM ONE DAY

- **Active time per day:** According to ACSM recommendation, children and adolescents should do one hour or more of physical activity every day. Being active in moderate to vigorous+ activity zones fills up the activity bar in the Polar activity monitor. It should be noted that one hour is the minimum target for students. Two hours of active time is rewarded with a sparkling animation in the Polar activity monitor.
- **The time in moderate, vigorous and vigorous+ zones:** There are several benefits for being active in the moderate to vigorous+ activity zones. Being active in any of these zones accumulates the recommended one hour of active time. Very active kids easily get the needed time in the vigorous+ activity zone, and even more. For active children, it is natural to move in the vigorous and vigorous+ activity zones. Children who are not very active or who are not used to exercising may not be able to accumulate much time in the vigorous+ activity zone. However, when children learn to be more active, they will progress and be able to spend more and more time in the vigorous+ activity zone as well. Meanwhile, they will reach their activity target by being active mainly in the moderate and vigorous activity zones.
- **Time in very easy and easy activity zones:** Children are in the very easy and easy activity zones when they are studying at school and doing homework. The time spent in these activity zones should be reduced by having less sedentary activities like watching TV or browsing the internet. Some authorities recommend to limit sedentary activities to two hours per day.
- **Steps:** The number of steps is displayed in the wrist unit, and the total daily number can be compared to recommendations. Moving legs while standing or very slow walking are not taken into account. Step information might be useful if you are having walk to school days, and in campaigns in which you want to convert the steps into distance. For example, a theme might be walking around the world.
- **Calories:** The activity monitor displays the total daily energy expenditure. The calorie analysis is very useful when it is related to health education and nutrition. Comparing energy expenditure between different days and estimating the meaning of active time in energy expenditure is a good way to explain the meaning of exercising in weight management.
- **Sleep time:** Sleep is important to children's health, development and well-being. Children aged 5-11 need 10-11 hours of sleep per night and children and adolescents aged 12 or over need 8-10 hours of sleep. A good rule of thumb is that 9 hours of sleep every night keeps the mind fresh. Good quality sleep gives the body a rest, improves learning ability in children and improves recovery from exercising. Poor or inadequate sleep can lead to mood swings and behavioral problems.

HOW TO USE INDIVIDUAL REPORTING TOOLS?

The daily activity diary: In the daily activity diary, students check the time spent in each activity zone, calorie and step information, and add this information to the diary sheet. Students can also color the time spent in each zone in the clock.

Daily Activity Diary	Your name & Activity monitor's identifier	Date
	Alex A1	3 March

1 sector = 1 hour (divided into 15 min. periods)

Active Time	
Time left to target	
Vigorous+	
Vigorous	
Moderate	
Easy	
Very easy	
Steps	
Calories	
Sleep (not visible in the activity monitor)	

An individual data analysis for longer periods: In detailed student information, students add the activity information from the wrist unit to the report template. The report is available in the web service as well, making it easier to follow big groups.

Name: Alex Allen

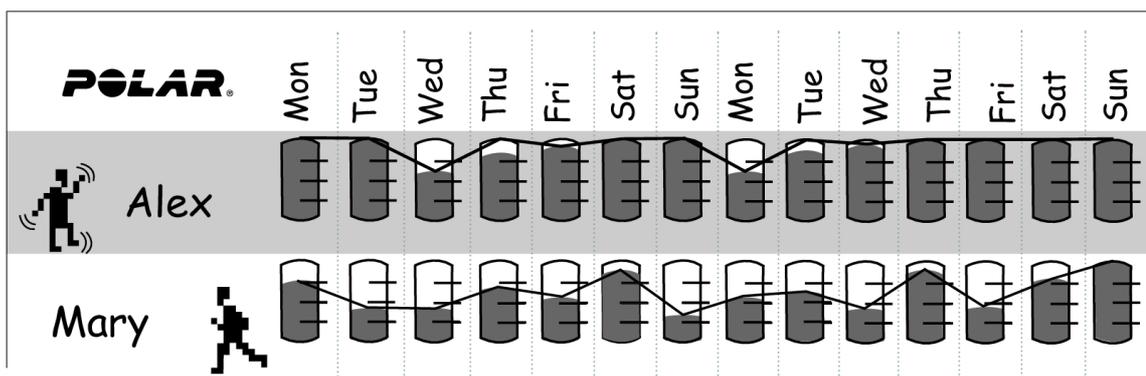


Date	Active time						Steps	Calories	Sleep
10/18	00:54	00:18	00:24	00:12	06:20	06:18	18246	1887	8 h
10/19	00:52	00:06	00:34	00:12	07:00	07:00	20724	2112	9 h
10/20	01:00	00:18	00:24	00:18	05:48	07:42	20286	1921	10 h
10/21	02:05	00:12	00:35	00:18	04:36	06:18	20441	1808	11 h
10/22	00:48	00:18	00:18	00:12	05:00	09:12	16511	2145	9 h

HOW TO ANALYZE GROUP DATA?

- See the overview of the class activity and check that the one-hour active time target is fulfilled by every student
- Check the curve view in web service to see how activity is distributed throughout the day
- Reward the whole group when activity targets are fulfilled, and plan supportive actions if needed

The activity progress posters: Students check their active time in the activity bar and color the bars in the activity progress poster. Filled activity bars can be linked with a trend graph showing the trend of activity during the week.



The activity progress sheet: Students can also color their information in your report sheet, which is easier to file and save for the future. Students can draw a trend graph between the bars to see their progress. The activity progress sheet can also be used for collecting a student's information and adding it into the student's portfolio.

The detailed group information sheet: In the detailed group information sheet students add their activity information from the wrist unit to the report template. You can have detailed one-day activity information from your group in one report template, making it easier to evaluate the activity level of the whole group.

Date: 10/18



Name	Grade	Active time						Steps	Calories	estimate Sleep
Billy A.	A	60 min.	00:18	00:24	00:18	05:48	07:42	20286	1921	9 h
Adam	C	38 min.	00:00	00:05	00:33	08:00	07:15	16086	2010	8.5 h
Alex	B	54 min.	00:18	00:24	00:12	06:18	07:18	18246	1887	9 h
Melissa	B	50 min.	00:18	00:20	00:12	07:00	08:13	18114	1960	8.5 h
Amy	C	45 min.	00:06	00:15	00:24	06:30	07:30	16324	1840	8.5 h

9. REFERENCES

1. ACSM's Guidelines for Exercise Testing and Prescription 2010 (2010). Lippincott, Williams and Wilkins, pp. 187-189.
2. Haskell WL, Lee I-Min, Pate RR, Powell KE, Blair SN, Franklin BA, Macera CA, Heath GW, Thompson PD, Bauman A (2007). Physical Activity and Public Health Updated Recommendation for Adults From the American College of Sports Medicine and the American Heart Association. *Circulation* 116:1081-1093.
3. Armstrong N, Balding J, Gentle P, Williams J, Kirby B (1990). Peak oxygen uptake and physical activity in 11 to 16 year olds. *Pediatric Exercise Science* 2, 349-358.
4. Armstrong N, Kirby BJ, McManus AM, Welsman JR (1995). Aerobic fitness of pre-pubescent children. *Annals of Human Biology* 22, 427-441.
5. Turley KR, Rogers DM, Harper KM, Kujawa KI, Wilmore JH (1995). Maximal treadmill versus cycle ergometry testing in children: Differences, reliability and variability of responses. *Pediatric Exercise Science* 7, 49-60.
6. Rabbia F, Grosso T, Cat Genova G, Conterno A, De Vito B, Mulatero P, Chiandussi L and Veglio F (2002). Assessing resting heart rate in adolescents: determinants and correlates. *Journal of Human Hypertension* 16, 327-332.
7. Singh TP, Rhodes J, Gauvreau K (2008). Determinants of heart Rate Recovery Following Exercise in Children. *Medicine and Science in Sports and Exercise* 40, 601-605.
8. Armstrong N. (2009) Exercise training: dose - response issues in children. Invited presentation to the Annual Conference of the European College of Sport Science, Oslo, Norway.
9. Firouzbakhsh S, Mathis RK, Dorchester WL, Oseas RS, Groncy PK, Grant KE, Finklestein JZ (1993). Measured resting energy expenditure in children. *Journal of Pediatric Gastroenterology and Nutrition* 16:136-142.
10. Tudor-Locke C, Pangrazi RP, Corbin CB, Rytherford WJ, Vincent SD, Raustorp A, Tomson LM, Cuddihy TF (2004). BMI-referenced standards for recommended pedometer-determined steps/day in children. *Preventive Medicine* 38(6):857-864.

10. TOOLS

A SAMPLE LETTER EXPLAINING POLAR HEART RATE MONITORS TO PARENTS

Dear Parents,

This year in physical education classes, all students will have the opportunity to use heart rate monitors. Heart rate monitors provide immediate feedback about the training intensity for each student, as well as for the teacher. A heart rate transmitter is worn around the chest, and the heart rate monitor receives heart rate information wirelessly from the heart rate transmitter. The heart rate monitor displays and records this heart rate data.

The invaluable information that each heart rate monitor provides students the opportunity to learn to exercise according to their individual level. With the help of heart rate monitors, our students will now be given credit for doing their personal best, and they will be exercising according to what is safe for their level. Heart rate summaries from each physical education class will be recorded for all students wearing a heart rate monitor. Students will now have documented data that proves exercise is truly an individual experience, and that their efforts in physical education class do count.

Because heart rate monitors require the use of a textile transmitter strap, the repeated use of it throughout the day for each PE class requires constant adjustment of the strap before the class. The strap must also be cleaned after each class. This results in extreme wear and tear on the textile straps.

We would like to offer all students the opportunity to purchase their own personal textile strap. This strap would be for their individual use. This eliminates the constant between-class cleansing of the straps. Individual textile straps give students a more personal involvement with the use of technology and the confidence that the textile straps are more easily kept clean.

The cost of one strap is _____. This one-time investment means your child does not have to share the strap with anyone else. If you should decide that this is an option you would like to choose, please send in _____ with your child.

Thank you for returning this form signed, and we look forward to an exciting school year using this new technology to bring safety, enjoyment and an individualized approach to exercising. Stop in and we are happy to demonstrate how the heart rate monitors work.

Yours in fitness and health,

A SAMPLE LETTER EXPLAINING POLAR ACTIVITY MONITORS TO PARENTS

Dear Parents

This year in physical education class all students will have the opportunity to use an activity monitor. Activity monitors provide feedback about the student's daily activity for the student, as well as for the teacher. Daily activity is recorded for each student wearing an activity monitor on their wrist. Activity monitors measure all of the movements during the day and night, and reward the student when the activity targets are achieved. If students wear activity monitors during the night, it is possible to follow their sleeping time as well.

The activity monitor provides invaluable information for each student, and gives them the opportunity to promote active lifestyle habits and exercise regularly. With the use of activity monitors, our students are now given credit for doing their personal best. Activity data from each day will be recorded for all students wearing activity monitors. Students will now have documented data about their daily activity and certainty that their efforts in physical education class do count.

We would like to offer all students the opportunity to purchase their own personal activity monitor. This activity monitor would be preset for their own individual use. An individual activity monitor gives the students a more personal involvement with the use of technology.

The cost of activity monitor is _____. This one-time investment means your child does not have to share the activity monitor with anyone else. If you should decide that this is an option you would like to choose, please inform the teacher about your interest to order a product.

Thank you for returning this form signed, and we look forward to an exciting school year using this new technology to bring safety, enjoyment and an individualized approach to daily activity. Stop in and we are happy to demonstrate how the activity monitors work.

Yours in fitness and health,

FACTORS AFFECTING HEART RATE

Heart rate is individual, and there are several factors affecting it. Below, the factors are divided into personal, exercise, situation and stress-based factors.

Personal factors:

- Age: The maximum heart rate usually decreases with age because the activity of the sympathetic nervous system decreases
- Gender: Women usually have higher heart rates compared to men because women typically have a lower $VO_{2\text{ max}}$ and smaller hearts
- Genetics: Some individuals have naturally higher or lower heart rates
- Fitness level: Fit adults' heart rates do not rise as fast during exercise. When fitness level improves, resting heart rate decreases and also recovers faster.

Exercise factors:

- Type of activity: Heart rate can change across activities due to different muscle mass involved, level of experience and technical proficiency. Running typically elicits the highest maximum heart rate during a stress test, whereas in cycling and paddling the maximum heart rate can be 10-15 beats lower during a similar test.
- Exercise intensity: Heart rate changes depending on how hard or fast you are working.
- Body position: Heart rate is lowest when lying down and increases in a standing position.

Situation factors:

- Heat and humidity: When the environment gets warmer and more humid, heart rate gradually increases, even if the pace doesn't change. You produce a lot of energy in the form of heat when you move, and this heat needs to be dissipated, typically by sweating. Humidity reduces the effectiveness of sweating, resulting in an increase in body temperature, and thus an increase in heart rate. Even if the humidity is low, heart rate will still be elevated, due the extra work the heart must do to help cool your body. It's not uncommon for heart rates to be 5-10 beats above normal range in these conditions. Use your heart rate combined with perceived exertion and subjective feeling to set an appropriate pace.
- Temperature: In a warm environment, the heart has to do extra work to cool the body, and therefore the heart rate rises.
- Altitude: The lower air pressure at higher altitudes means there is less pressure to drive oxygen into your lungs. Less pressure means your heart has to work harder to deliver enough oxygen to your working muscles. The result is a higher heart rate at a given pace. However, your body adapts to higher altitude in a time period of several days to two weeks. If you're at a higher altitude only a short period of time, you'll need to slow your pace to keep your heart rate in the proper range. It also takes longer to recover from a hard effort at a higher altitude, so resting periods may need to be longer.
- Time of day: Heart rate tends to be lowest in the morning and after resting.

ENGLISH

Stress factors:

- Hydration level: Failing to stay hydrated can result in an increase in heart rate, as your blood volume decreases and your body runs low on the fluids needed to maintain body temperature. Dehydration can occur in cold as well as hot environments. If you notice your heart rate increasing with no change in pace or other variables, then increase your fluid intake.
- Nutrition: Your body is always using a combination of carbohydrates, fats and proteins for energy production. As the exercise intensity increases, you burn more carbohydrates and less fat. Protein metabolism is always fairly small. Even at low intensities, you need some carbohydrate to burn fats, because fats burn in the flame of carbohydrate. If you start to run low on carbohydrates, it becomes difficult to maintain your pace at a given heart rate. Your perceived exertion and subjective feeling will increase, but your heart rate will be falling. This can be corrected by eating foods high in carbohydrate. As a rule of thumb, always bring along some form of ingestible energy on any outing lasting more than two hours.
- Medication can affect your heart rate by either raising (e.g. asthma medication) or lowering it (e.g. heart and blood pressure medication)
- Smoking, alcohol and caffeine raise heart rate
- Stressed situations, anger or illness can raise heart rate

HEART RATE ZONES FOR ADULTS



Heart rate zone	Physiological benefits	Feels like	Recommended for
90-100%	Develops maximum performance and speed	Very exhausting for breathing and muscles	Fit persons and for athletic training
80-90%	Increases maximum performance capacity	Muscular fatigue and heavy breathing	Everybody for shorter exercises
70-80%	Improves aerobic fitness	Light muscular strain, easy breathing, moderate sweating	Everybody for moderately long exercises
60-70%	Improves basic endurance and fat burning	Comfortable, easy breathing, low muscle load, light sweating	Everybody for longer and frequently repeated shorter exercises
50-60%	Improves overall health and helps to recover	Very easy for breathing and muscles	Weight management and active recovery

HEART RATE ZONES FOR CHILDREN AND ADOLESCENTS



Heart rate zone	Physiological benefits	Feels like	Recommended for
90-100%	Develops maximum performance and speed	Very exhausting for breathing and muscles	For athletic training and everybody for shorter sprints
70-90%	Improves aerobic fitness and performance capacity	Light muscular strain, easy or heavy breathing, moderate sweating	Everybody for moderately long exercises and repeated shorter exercises during the exercise phase
60-70%	Improves basic endurance and fat burning	Comfortable, easy breathing, low muscle load, light sweating	Everybody for warm-up and cool-down. Also for longer exercises and frequently repeated shorter exercises.

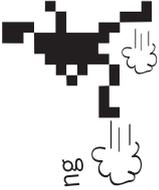
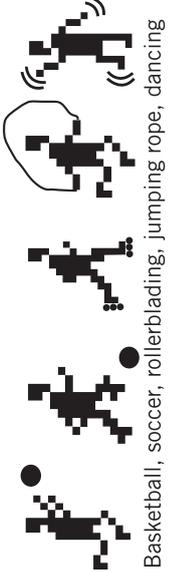
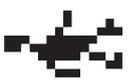
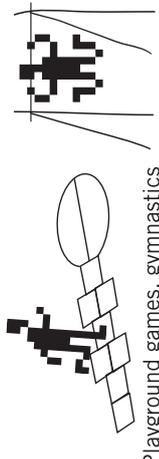
1-WEEK TRAINING PROGRAM TEMPLATE

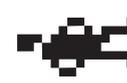
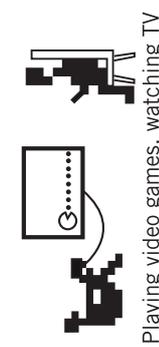


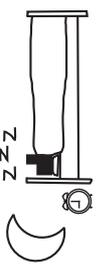
	Type of activity	Time in the target zone	HR _{avg}	HR _{max}	Duration	Calories
Monday	Planned:	Planned:	Actual:	Actual:	Planned:	Actual:
	Actual:	Actual:			Actual:	
Tuesday	Planned:	Planned:	Actual:	Actual:	Planned:	Actual:
	Actual:	Actual:			Actual:	
Wednesday	Planned:	Planned:	Actual:	Actual:	Planned:	Actual:
	Actual:	Actual:			Actual:	
Thursday	Planned:	Planned:	Actual:	Actual:	Planned:	Actual:
	Actual:	Actual:			Actual:	
Friday	Planned:	Planned:	Actual:	Actual:	Planned:	Actual:
	Actual:	Actual:			Actual:	
Saturday	Planned:	Planned:	Actual:	Actual:	Planned:	Actual:
	Actual:	Actual:			Actual:	
Sunday	Planned:	Planned:	Actual:	Actual:	Planned:	Actual:
	Actual:	Actual:			Actual:	



POLAR ACTIVITY ZONES

ZONE	EXAMPLE ACTIVITIES	RECOMMENDATION	BENEFITS
 VIGOROUS +	 Fast running	<p>Be active for more than one hour every day!</p>  Being active in Moderate to Vigorous+ zones fills up the Activity bar in your Polar activity monitor.	Improves maximum performance and cardiovascular fitness Helps improve speed
 VIGOROUS	 Basketball, soccer, rollerblading, jumping rope, dancing		Improves cardiovascular endurance Promotes bone health Helps increase power
 MODERATE	 Playground games, gymnastics		Helps maintaining a healthy body weight Helps increase flexibility

 EASY	 Playing catch Slow walking Stretching	<p>It's better to get up and move than sit still!</p>
 VERY EASY	 Playing video games, watching TV	<p>You can sit at school, otherwise get up and move!</p>

 SLEEPING	<p>9 hours of sleep every night will keep your mind fresh!</p>	<p>Improves learning ability Gives your body a rest</p>
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INSTRUCTIONS FOR FILLING IN THE DAILY ACTIVITY DIARY

STEP 1

1. Students fill in their names (and activity monitors' identifiers) and the dates they are going to examine.
2. Students color the circles in the activity zone boxes with different colors or patterns. (Teacher can specify common colors for the whole class.)

STEP 2

1. Students select the day they wish to examine closer from their activity monitors' diary.
2. Students check and write down the activity data from the selected day to the corresponding boxes in the activity diary:
 - Active time
 - Time left to target (If a student has reached the daily activity target, she/he can draw a smiley face in the box.)
 - Time spent on each activity zone
 - Steps
 - Calories

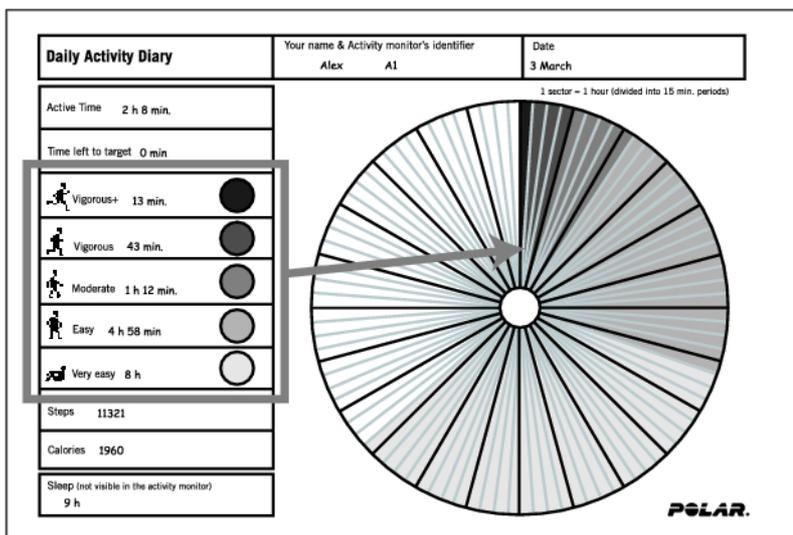
Notice that sleep time is not shown in the activity monitor's diary. It can only be seen in the web service after a student's activity data has been downloaded there.

STEP 3

The circle in the daily activity diary represents a day. It has been divided into 24 sectors. Each sector stands for an hour. Each hour has been divided into four 15 minutes phases.

Advise students to color the number of sectors that corresponds to the time they have marked in each activity zone box.

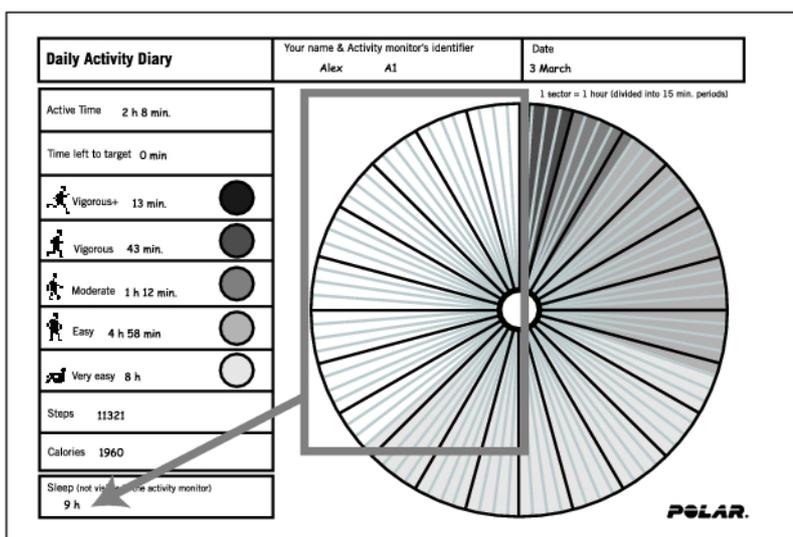
Notice that it may not be necessary to color the sectors accurately minute by minute. A 15-minute or a half an hour accuracy gives students a good idea about their daily activity.



STEP 4

When the time spent in each activity zone has been colored in the daily activity diary, the remaining blank sections stand for sleep. By counting the sections, students get rough estimates of their sleeping time.

Notice that sleep time is not shown in the activity monitor's diary. It can only be seen in the web service after a student's daily activity data has been downloaded there.



ENGLISH

Counting the actual sleeping time

1. Sum up the times in the activity zones. Remember that 60 minutes = 1 hour.

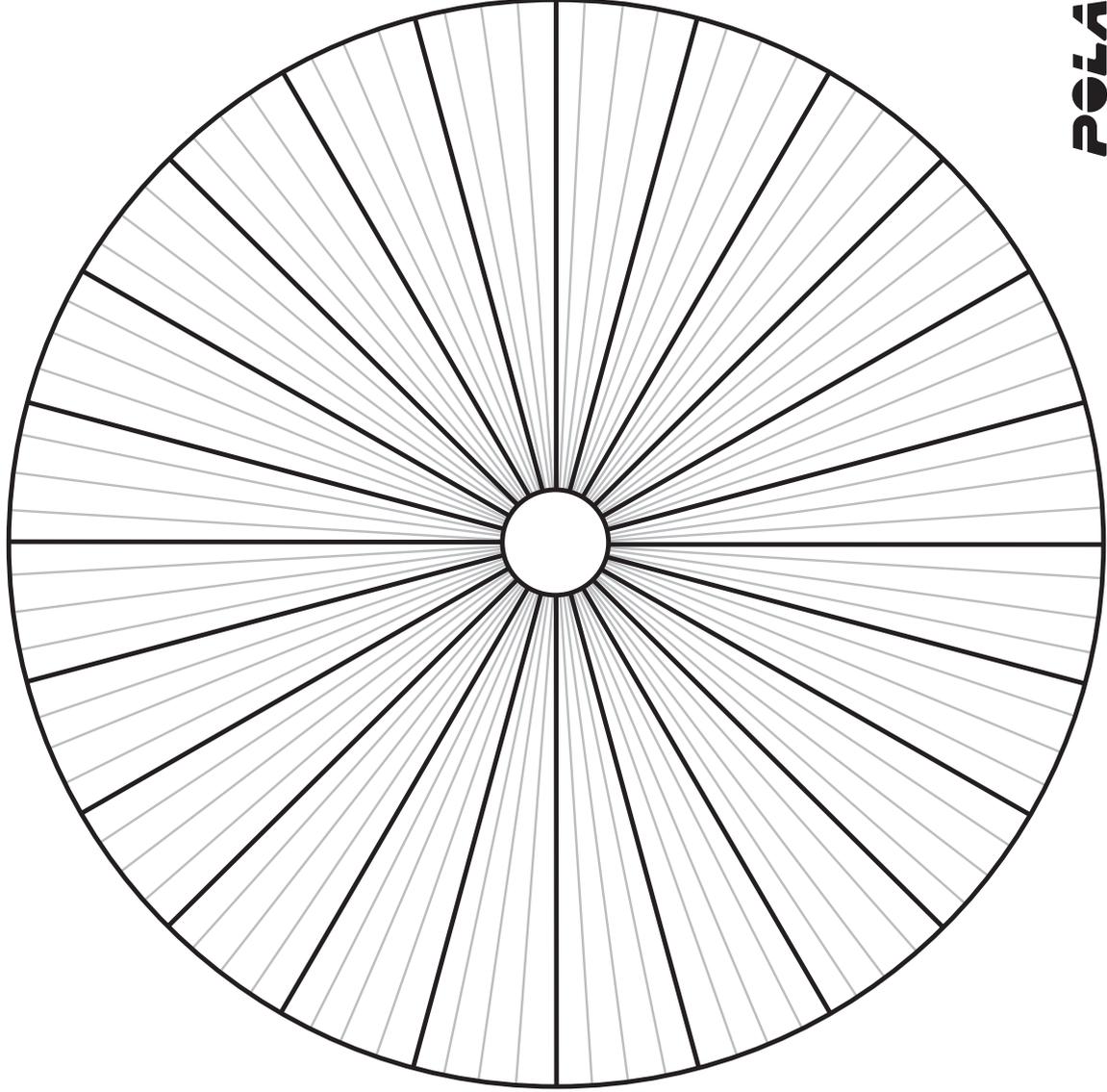
	Hours	Minutes
Vigorous+	00	13
Vigorous	00	43
Moderate	01	12
Easy	04	58
Very Easy	08	00
Total	13	126
—>	15	6

2. To calculate the sleep time, subtract the total time on all activity zones from 24 hours. —>
 $24:00:00 - 15:06:00 = 08:54:00$

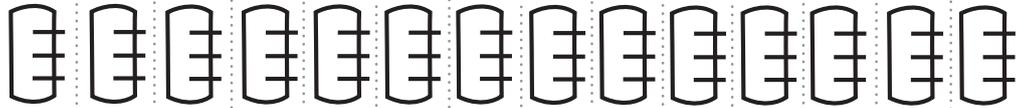
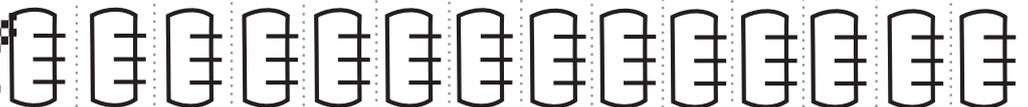
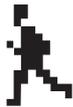
Daily Activity Diary	Your name & Activity monitor's identifier	Date
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Active Time	Time left to target	 Vigorous+ <input data-bbox="587 1503 678 1597" type="radio"/>	 Vigorous <input data-bbox="707 1503 798 1597" type="radio"/>	 Moderate <input data-bbox="826 1503 917 1597" type="radio"/>	 Easy <input data-bbox="944 1503 1035 1597" type="radio"/>	 Very easy <input data-bbox="1061 1503 1152 1597" type="radio"/>	Steps	Calories	Sleep (not visible in the activity monitor)				
Steps	Calories	Sleep (not visible in the activity monitor)											

1 sector = 1 hour (divided into 15 min. periods)



POLAR



EVERY DAY

minimum

60

MINUTES

POLAR®