TATA CONSULTANCY SERVICES | Discovery EDUCATION

IGNITE MY FUTURE

THINK SOLVE CREATE CONNECT

SUBJECTS

Science
Health
Physical Education

COMPUTATIONAL THINKING PRACTICE

Fostering an Inclusive Computing Culture

Collaborating Around Computing

Communicating About Computing

COMPUTATIONAL THINKING STRATEGIES

Find Patterns
Build Models

MATERIALS

User Profile Student Prompt

User Profile
Student Capture Sheet

Body Systems
Student Capture Sheet

Exercise Research
Student Capture Sheet

Shoe Prototype Design
Student Capture Sheet

Model Exercise Plan
Student Capture Sheet

Computers with access to the Internet (optional)

LESSON TITLE

The Science of Sports

Guiding Question: What Does Happiness Mean?

Ignite Curiosity

- What feelings do you experience when you are exercising? How about afterwards?
- Are our physical and emotional states more connected than we might think?
- Can the clothes that we wear increase our happiness?

In this lesson, students use the computational thinking strategies of finding patterns and building models to investigate how physical activity affects emotional health. Students will simulate the role of sports scientists working for an apparel company that is developing a shoe that can improve both physical and emotional health. The company will market the shoes with an exercise program that the wearer can follow to increase their happiness. In **THINK**, students will understand how different systems within the body affect one another—from muscles to bones, from hormones to cells. In **SOLVE**, they will identify patterns between physical activity and emotional well-being. They will then use the patterns they have identified to **CREATE** a prototype of a shoe with identifiable features that will help the wearer experience more happiness. Students will then design an adjoining exercise program based in exercise science that capitalizes on the design features of the shoes. In **CONNECT**, students will explore careers in health and exercise science.

Students will be able to:

- **Analyze** the anatomy of the human body to understand how physical and emotional health are linked
- **Create** a prototype and complementary exercise plan based on anatomical research
- **Evaluate** how exercise impacts physical health and feelings of happiness

Students act as sports scientists who are challenged with developing a new shoe and adjoining exercise routine that can help the user experience more happiness.

1 **Read** the following to students:

Imagine that you are a scientist working for an athletic apparel company. Recent studies have shown that exercise and movement have a profound impact on emotional health as well as physical health. Your company wants to design a new shoe that can help the wearer experience greater happiness. Also, they want to market the shoe with a movement routine designed to maximize the function of the shoe and increase happiness. Can you think like a computer to design a shoe that increases happiness?

2 **Explain** to the students that when product developers begin designing a new product, they have to think about the end-users first. Divide students into groups of four or five and provide each group with a user profile from the User Profile student prompt. Each student group should provide a visual and written profile for their assigned end-user that includes age, athletic ability, overall level of health, and interests/hobbies.

3 **Once each group has created their end-user,** write the following body systems on the board in a chart, leaving space underneath each body system for students to write (you may also choose to complete this exercise using large-scale notepads and markers):

- The skeletal system
- The muscular system
- The circulatory system
- The respiratory system
- The endocrine system
- The immune system
- The digestive system
- The nervous system

4 **Assign** one or two body systems to each student group. Provide students with up to 10 minutes to complete the Body Systems student capture sheet. Students may use a variety of resources to complete their capture sheets. If your classroom is equipped with computers and has access to the Internet, provide each student group with one to three laptops so that they can use the linked resources on the Body Systems capture sheet to complete their research. If not, you can print out the linked resources ahead of time and distribute to the student groups.

5 **When each group has completed their research,** ask one representative to come up to the board and list one way that the body system they have been assigned impacts physical health.

6 **Next,** have another representative come up to the board and write how their assigned body system affects mental well-being.

7 **Finally,** have another representative come up to the board and write which systems operate closely with the system that they have been assigned.

Optional extension: Provide students with an in-depth understanding of how body systems work together during exercise with this video from SickKids hospital.

8 **Summarize and check** for understanding by asking students to respond to the following critical thinking questions, either out loud or within their group setting:

- What surprising connections exist between different body systems?
- What happens when you focus too much on one body system without thinking of others?
- Are there any body systems that are not impacted when you exercise?
- What patterns do you see between body systems? How can you use those patterns to develop a shoe that improves physical and emotional health?

Students explore the mental health benefits of different types of exercise:

1. **Divide** students into new groups and make sure to diversify so that each new group contains students who researched different body systems in the "Think" section.

2. **Instruct** groups to review the Exercise Research student capture sheet and choose three or four types of exercises to research. They will complete the first column 'Type of Exercise' with their choices. Students will study their selected exercises in order to find the following:
   - Repetitive motions and patterns
   - Impact on different body systems during and after activity
   - Accessibility of the activity for individuals from various physical, environmental, and socioeconomic backgrounds

3. **Provide** groups with ample time to complete their capture sheets, circulating amongst groups in order to answer any questions that arise.

4. **When groups have completed their capture sheets,** ask them to assign a "happiness score" to each of the activities they have researched, based on the levels of fun and accessibility of the activity.

5. **Show** this short article and video by CBC about how watching cute animal videos impacts our brain chemistry. (Caution: Please preview the video beforehand to ensure that it is appropriate for your students.) When the video is over, ask students to review their "happiness scores" and see if they would revise them based on what they have learned about endorphins, serotonin, and other chemicals in the brain.

6. **Summarize and check** for understanding by asking students to respond to the following critical thinking questions, either out loud or within their group setting:
   - How are emotions linked to exercise?
   - Does exercise need to be strenuous in order to improve our physical and emotional well-being? Why or why not?
   - Think back to the user profiles that you developed at the beginning of this lesson. What are the similarities and differences between users? Can you design a shoe that would work for all of them? Why or why not?
   - How does the computational thinking strategy of finding patterns help us to understand our bodies? How can you use the strategy of finding patterns to design an athletic shoe?

Students develop a model of an athletic shoe and an adjoining physical activity plan designed to help the wearer experience better physical and emotional health.

1. **Distribute** students into new groups. Hand out the Shoe Prototype Design student capture sheet. Instruct students that they will be working in these groups to compile what they have learned while designing a prototype for an athletic shoe and an adjoining exercise program that will increase physical and emotional well-being.

2. **Instruct** each group to select the following:
   - One user from the User Profile student capture sheet that will serve as the end-user of their shoe and exercise plan
   - One body system that the shoe will be specifically designed to support
   - Three activities from the Exercise Research student capture sheet with the highest "happiness score". Their shoe design and adjoining exercise plan should take these activities into account.

3. **Provide** each group with time to review their selections and begin designing their shoe with these selections in mind. Students can use paper, markers, and other art supplies to design their prototype in the space provided on the Shoe Prototype Design student capture sheet.

   Optional extension: Optional extension: if your classroom has computers with access to the Internet, you can have students design their prototype using the online application TinkerCAD and modify an existing CAD design on the website (viewable in the gallery).

4. **Once groups have designed their shoe prototype,** instruct them to create an adjoining exercise plan to market with the shoe on the Model Exercise Plan student capture sheet.

5. **Have each student group briefly present** their shoe design and exercise plan to the class. When each group has presented, check for understanding by asking the following summarizing questions:
   - What similarities and differences did you notice between the different shoe designs and exercise plans?
   - If you were going to design this shoe in real life, what would be your next step? Why?
   - How does building models help you create better products? How can thinking like computers help you develop smarter technology?

IGNITEMYFUTURE

THINK SOLVE CREATE CONNECT

Select one of the strategies listed below to help students answer these questions:

- **How do this problem and solution connect to me?**
- **How do this problem and solution connect to real-world careers?**
- **How do this problem and solution connect to our world?**

1. **Write** these three questions on PowerPoint or flip chart slides and invite students to share out responses.
2. **Display** chart paper around the room, each with one question written on it. Ask students to write down their ideas on each sheet.
3. **Assign** one of the questions to three different student groups to brainstorm or research, and then share out responses.
4. **Invite** students to write down responses to each question on a sticky note, and collect them to create an affinity diagram of ideas.

How does this connect to students?

Students will gain insight into the many health benefits of different types of exercise and how to use technology to communicate these effects. They will understand the scientific foundations of health and identify how to improve both physical and mental well-being. Students can apply their research from this lesson to many real-world applications, such as after-school sports, clubs and other physical activities. Students will understand that while socioeconomic and health factors might impact a person's ability to lead an active lifestyle, there are steps that everyone can take to improve their health.

How does this connect to careers?

Health Educators teach people about behaviours that promote wellness. They develop and implement strategies to improve the health of individuals and communities.

Personal Trainers and **Fitness Instructors** lead, instruct, and motivate individuals or groups in exercise activities, including cardiovascular exercises (exercises for the heart and blood circulation), strength training, and stretching. They work with people of all ages and skill levels.

Neuroscientists conduct research aimed at improving overall human brain and nervous system health. They often use clinical trials and other investigative methods to reach their findings.

Psychologists study cognitive, emotional, and social processes and behaviour by observing, interpreting, and recording how people relate to one another and their environments.

How does this connect to our world?

In an increasingly stressful world, people need to find moments of calmness to recharge, and research has shown that exercise has benefits beyond physical conditioning. Everyone can find a restorative state through exercise. But with so many different types of exercise, what types are best for each person? Computational thinking strategies harness the power of technology to bring the health benefits of exercise to everyone, no matter what that exercise might be.

TATA Consultancy services has numerous sports sponsorships to help promote active healthy living among its employees and the community it works in. Click here to learn more.

Find more easy-to-implement resources to integrate computational thinking practices into your classroom by visiting **ignitemyfutureinschool.ca**

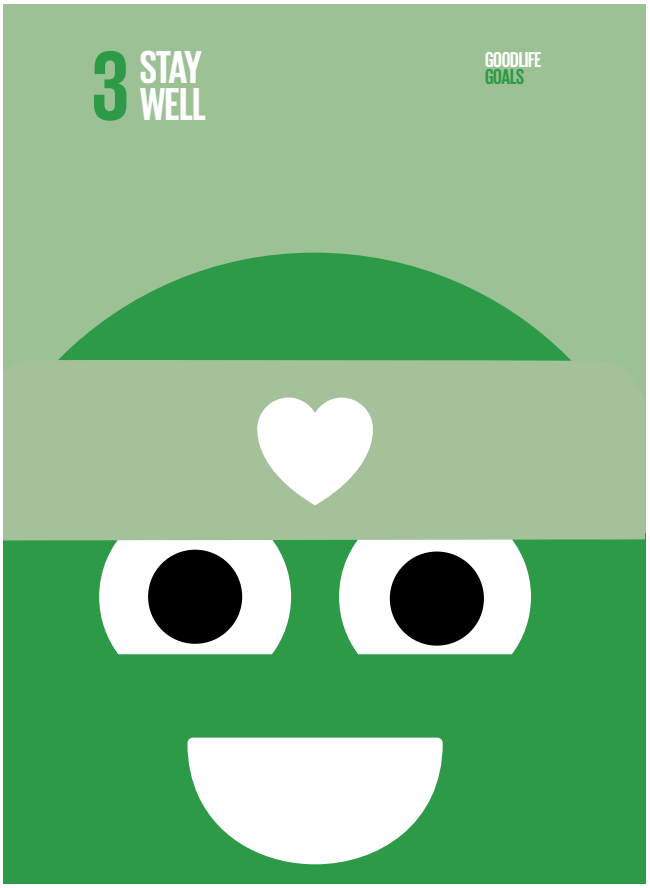
Curriculum Connections

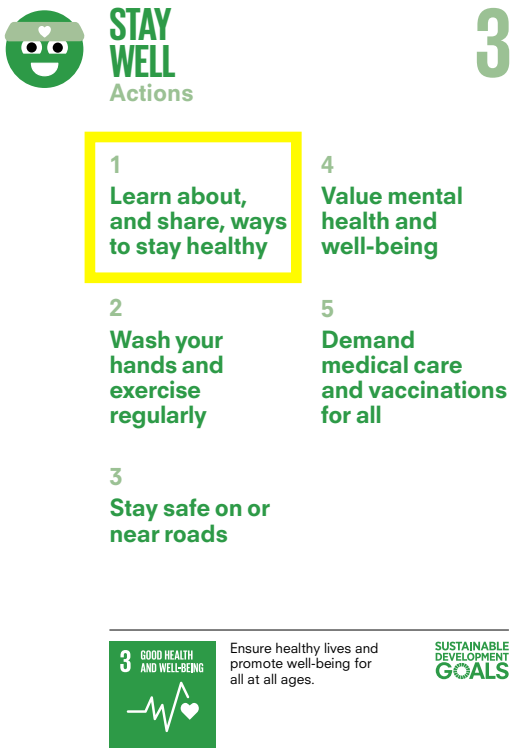
UNITED NATIONS SUSTAINABLE DEVELOPMENT GOALS

3 GOOD HEALTH AND WELL-BEING

"For the goals to be reached, everyone needs to do their part: governments, the private sector, civil society and **people like you**."
–The United Nations

"The Sustainable Development Goals are the blueprint for a better future. And together we can reach them. By following the Good Life Goals, we can all help make tomorrow better than today. Let's do this! #GoodLifeGoals"





Source:
[The Good Life Goals by Futerra Sustainability Communications Ltd and 10-Year Framework of Programmes on Sustainable Lifestyles and Education Programme is licenced under CC BY-ND 4.0.]

Find more easy-to-implement resources to integrate computational thinking practices into your classroom by visiting **ignitemyfutureinschool.ca**

Global Competencies

CMEC (Council of Ministers of Education, Canada) Pan-Canadian Global Competencies Descriptions

Highlighted sections apply to this lesson

Global Competency	Definition	Student Descriptors
Collaboration	Collaboration involves the interplay of the cognitive (including thinking and reasoning), interpersonal, and intrapersonal competencies necessary to participate effectively and ethically in teams. Ever-increasing versatility and depth of skill are applied across diverse situations, roles, groups, and perspectives in order to co-construct knowledge, meaning, and content, and learn from, and with, others in physical and virtual environments.	Students participate in teams by establishing positive and respectful relationships, developing trust and acting co-operatively and with integrity. Students learn from and contribute to the learning of others by co-constructing knowledge, meaning, and content. Students assume various roles on the team, respect a diversity of perspectives, and address disagreements and manage conflict in a sensitive and constructive manner. Students network with a variety of communities/ groups and use an array of technology appropriately to work with others.
Communication	Communication involves receiving and expressing meaning (e.g., reading and writing, viewing and creating, listening and speaking) in different contexts and with different audiences and purposes. Effective communication increasingly involves understanding both local and global perspectives, societal and cultural contexts, and adapting and changing using a variety of media appropriately, responsibly, safely, and with regard to one's digital footprint.	Students communicate effectively in different contexts in oral and written form in French and/ or English through a variety of media. Students communicate using the appropriate digital tools and create a positive digital footprint. Students ask effective questions to acquire knowledge, listen to understand all points of view, voice their own opinions, and advocate for ideas. Students gain knowledge about a variety of languages and understand the cultural importance of language.

Global Competencies cont.

Highlighted sections apply to this lesson

Global Competency	Definition	Student Descriptors
Global Citizenship and Sustainability	Global citizenship and sustainability involve reflecting on diverse worldviews and perspectives and understanding and addressing ecological, social, and economic issues that are crucial to living in a contemporary, connected, interdependent, and sustainable world. It also includes the acquisition of knowledge, motivation, dispositions, and skills required for an ethos of engaged citizenship, with an appreciation for the diversity of people, perspectives, and the ability to envision and work toward a better and more sustainable future for all.	Students understand the ecological, economic, and social forces, their interconnectedness, and how they affect individuals, societies, and countries. Students take actions and responsible decisions that support quality of life for all, now and in the future. Students recognize discrimination and promote principles of equity, human rights, and democratic participation. Students understand Indigenous traditions and knowledge and its place in Canada, learn from and with diverse people, develop cross-cultural understanding, and understand the forces that affect individuals, societies, and nations. Students engage in local, national, and global initiatives to make a positive difference. Students contribute to society and to the culture of local, national, global, and virtual communities in a responsible, inclusive, accountable, sustainable, and ethical manner. Students as citizens participate in networks in a safe and socially responsible manner.

Global Competencies cont.

Highlighted sections apply to this lesson

Global Competency	Definition	Student Descriptors
Critical Thinking and Problem Solving	Critical thinking and problem solving involve addressing complex issues and problems by acquiring, processing, analysing, and interpreting information to make informed judgments and decisions. The capacity to engage in cognitive processes to understand and resolve problems includes the willingness to achieve one's potential as a constructive and reflective citizen. Learning is deepened when situated in meaningful, real-world, authentic experiences.	Students will solve meaningful, real-life, complex problems by taking concrete steps to address issues and design and manage projects. Students will engage in an inquiry process to solve problems as well as acquire, process, interpret, synthesize, and critically analyse information to make informed decisions (i.e., critical and digital literacy). Students will see patterns, make connections, and transfer what they have learned from one situation to another, including in real world applications. Students will construct, relate, and apply knowledge to all domains of life such as school, home, work, friends, and community. Students will analyze the functions and interconnections of social, economic, and ecological systems.
Innovation, Creativity and Entrepreneurship	Innovation, creativity, and entrepreneurship involve the ability to turn ideas into action to meet the needs of a community. The capacity to enhance concepts, ideas, or products to contribute new-to- the-world solutions to complex economic, social, and environmental problems involves leadership, taking risks, independent/unconventional thinking and experimenting with new strategies, techniques, or perspectives, through inquiry research. Entrepreneurial mindsets and skills involve a focus on building and scaling an idea sustainably.	Students formulate and express insightful questions and opinions to generate novel ideas. Students contribute solutions to complex economic, social, and environmental problems or to meet a need in a community in a number of ways including; enhancing concepts, ideas, or products through a creative process, taking risks in their thinking and creating, making discoveries through inquiry research, and by hypothesizing and experimenting with new strategies or techniques. Students demonstrate leadership, initiative, imagination, creativity, spontaneity, and ingenuity in a range of creative processes and motivate others with an ethical entrepreneurial spirit.

Global Competencies cont.

Highlighted sections apply to this lesson

Global Competency	Definition	Student Descriptors
Learning to learn and to be self-directed and self-aware	Learning to learn and to be self-directed and self-aware, means: becoming aware and demonstrating agency in one's process of learning, including the development of dispositions that support motivation, perseverance, resilience, and self-regulation. Belief in one's ability to learn (growth mindset), combined with strategies for planning, monitoring and reflecting on one's past, present, and future goals, potential actions and strategies, and results. Self-reflection and thinking about thinking (metacognition) promote lifelong learning, adaptive capacity, well-being, and transfer of learning in an ever-changing world.	Students learn the process of learning (metacognition) (e.g., independence, goal-setting, motivation) and believe in their ability to learn and grow (growth mindset). Students self-regulate in order to become lifelong learners and reflect on their thinking, experience, values, and critical feedback to enhance their learning. They also monitor the progress of their own learning. Students develop their identity in the Canadian context (e.g., origin and diversity) and consider their connection to the environment. They cultivate emotional intelligence to understand themselves and others. They take the past into account to understand the present and approach the future. Students develop personal, educational, and career goals and persevere to overcome challenges to reach these goals. They adapt to change and show resilience to adversity. Students manage various aspects of their lives: physical, emotional (relationships, self-awareness), spiritual, and mental well-being.

User Profiles Prompts

1. **Dahlia** is a 14-year-old student who likes to play a wide variety of sports. She lives in a rural area and has been active her whole life. Her favourite activities include horseback riding, soccer, and playing with her dogs. Dahlia has asthma and seasonal allergies.

2. **Fred** is 73 years old and retired. He is recovering from a stroke. Fred is learning to walk again with the help of his physical therapist. Prior to his stroke, Fred liked to go for walks around the neighbourhood with his wife. Fred lives in a suburban neighbourhood with lots of public transit options.

3. **Molly** is 32 years old and has two young children. She works full time as a lawyer and lives in a busy city. Between her young children and her stressful job, Molly does not have a lot of time to work out. She is frequently tired and experiences a lot of stress.

4. **David** is 45 years old. David is a truck driver and spends long hours on the road without stopping. He spends most of his days sitting and driving. David is diagnosed with Type 2 diabetes after he recently visited the doctor to complain about a pain in his leg. David knows he has to improve his physical health, but he doesn't know where to start.

5. **Juan** is a 25-year-old chef who spends a lot of time in the kitchen. He works long hours, often late at night, and sleeps during the day. The hard floors of the kitchen have caused him to have some hip pain and he wants to find a way to continue his passion for cooking while improving his physical health. Juan lives in the suburbs and commutes to the city every day.

6. **Gloria** is a 55-year-old nurse practitioner who works in a busy hospital. She recently lost her mother and is going through a hard time. She has begun seeing a therapist who suggested that spending more time in nature might help her mental health. Gloria lives in an urban setting and wants to make an effort to get out to the country more. She has two dogs and likes to swim and hike. She was on the cross country team in college but has not been consistent since graduation.

User Profiles Capture Sheet

User Name:

User Age:

User Gender:

User Living Environment:

User Occupation:

User Interests and Hobbies:

User Health Concerns:

Based on the above data, what do you think this user is looking for in an athletic shoe?

How can you help this person improve their mental and physical health?

What special considerations might this person have that separate them from other users? How can you design a product specifically for them?

Body Systems Capture Sheet

Body System	Impacts on Physical Health	Affects on Mental Well-Being

Additional Notes:

Exercise Brainstorm and Research

Type of Exercise	Level of Ability Needed	Indoors, Outdoors, or Both?	Required Equipment	Useful Across Diverse Population?	Correlates to Happiness?

Additional Notes:

Shoe Prototype Design

User Name:

User Bio:

Special Considerations:

Body System(s) the Shoe will Support:

Three Activities the Shoe will be Designed for:

Draw your shoe prototype in the space below, and make sure to identify any key design features.

Model Exercise Plan

User Name:

Type of Exercise	Level of Ability Needed	Indoors, Outdoors, or Both?	Required Equipment	Why is this exercise a good choice for this individual?

Additional Notes: