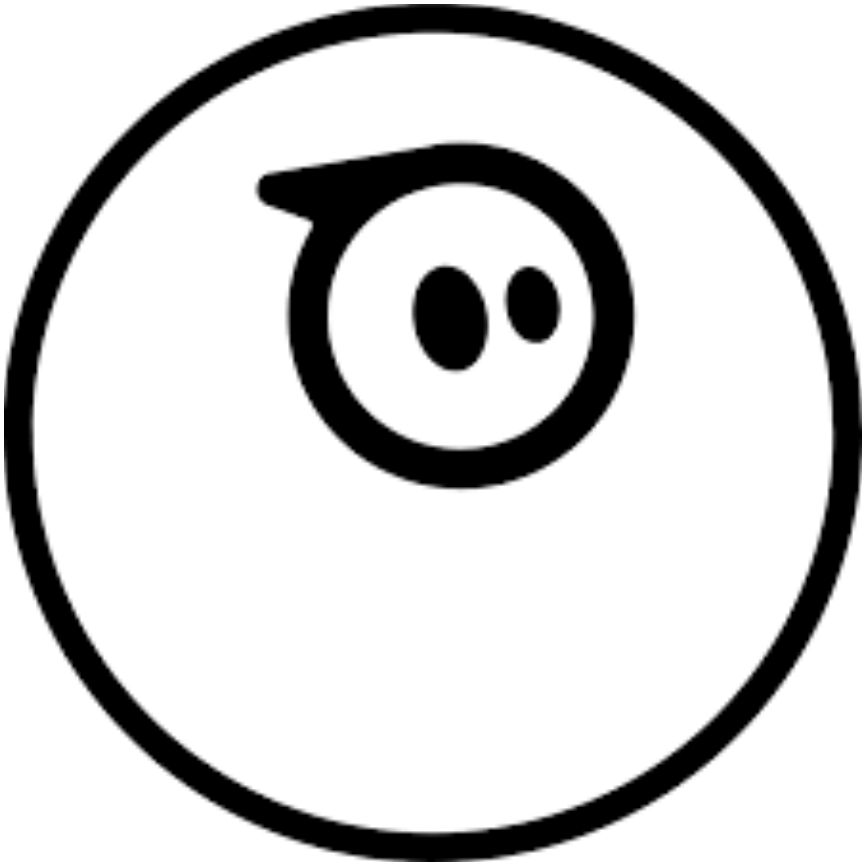
Spheros in the Classroom



Lessons and Activities compiled by Doug David, Robert Douglas
and Robert Russell-Atkinson, sd71 Comox Valley

BIG IDEAS

Designs grow out of natural curiosity.	Skills can be developed through play.	Technologies are tools that extend human capabilities.

Learning Standards

Curricular Competencies	Content
Students are expected to be able to do the following: **Applied Design** ***Ideating*** • Identify needs and opportunities for designing, through exploration • Generate ideas from their experiences and interests • Add to others' ideas • Choose an idea to pursue ***Making*** • Choose tools and materials • Make a **product** using known procedures or through modelling of others • Use trial and error to make changes, solve problems, or incorporate new ideas from self or others ***Sharing*** • Decide on how and with whom to **share** their product • Demonstrate their product, tell the story of designing and making their product, and explain how their product contributes to the individual, family, community, and/or environment • Use personal preferences to evaluate the success of their design solutions • Reflect on their ability to work effectively both as individuals and collaboratively in a group **Applied Skills** • Use materials, tools, and technologies in a safe manner in both physical and digital environments • Develop their skills and add new ones through play and collaborative work **Applied Technologies** • Explore the use of simple, available tools and **technologies** to extend their capabilities	*Students are expected to use the learning standards for Curricular Competencies from Applied Design, Skills, and Technologies K–3 in combination with grade-level content from other areas of learning in cross-curricular activities to develop foundational mindsets and skills in design thinking and making.*

BIG IDEAS

Designs can be improved with prototyping and testing.	Skills are developed through practice, effort, and action.	The choice of technology and tools depends on the task.

Learning Standards

Curricular Competencies	Content
Students are expected to be able to do the following: **Applied Design** *Understanding context* • Gather information about or from potential **users** ***Defining*** • Choose a design opportunity • Identify key features or user requirements • Identify the main objective for the design and any **constraints** ***Ideating*** • Generate potential ideas and add to others' ideas • Screen ideas against the objective and constraints • Choose an idea to pursue ***Prototyping*** • Outline a general plan, identifying tools and materials • Construct a first version of the **product**, making changes to tools, materials, and procedures as needed • Record **iterations** of prototyping ***Testing*** • Test the product • Gather peer feedback and inspiration • Make changes and test again, repeating until satisfied with the product	*Students are expected to use the learning standards for Curricular Competencies from Applied Design, Skills, and Technologies 4–5 in combination with grade-level content from other areas of learning in cross-curricular activities to develop foundational mindsets and skills in design thinking and making.*

Learning Standards (continued)

Curricular Competencies	Content
Making • Construct the final product, incorporating planned changes ***Sharing*** • Decide on how and with whom to **share** their product • Demonstrate their product and describe their process • Determine whether their product meets the objective and contributes to the individual, family, community, and/or environment • Reflect on their design thinking and processes, and their ability to work effectively both as individuals and collaboratively in a group, including their ability to share and maintain a co-operative work space • Identify new design issues **Applied Skills** • Use materials, tools, and technologies in a safe manner, and with an awareness of the safety of others, in both physical and digital environments • Identify the skills required for a task and develop those skills as needed **Applied Technologies** • Use familiar tools and **technologies** to extend their capabilities when completing a task • Choose appropriate technologies to use for specific tasks • Demonstrate a willingness to learn new technologies as needed	

BIG IDEAS

Design can be responsive to identified needs.	Complex tasks require the acquisition of additional skills.	Complex tasks may require multiple tools and technologies.

Learning Standards

Curricular Competencies	Content
Students are expected to be able to do the following: **Applied Design** *Understanding context* • **Empathize** with potential **users** to find issues and uncover needs and potential design opportunities ***Defining*** • Choose a design opportunity • Identify key features or potential users and their requirements • Identify criteria for success and any **constraints** ***Ideating*** • Generate potential ideas and add to others' ideas • Screen ideas against criteria and constraints • Evaluate personal, social, and environmental impacts and ethical considerations • Choose an idea to pursue ***Prototyping*** • Identify and use **sources of information** • Develop a plan that identifies key stages and resources • Explore and test a variety of materials for effective use • Construct a first version of the **product** or a prototype, as appropriate, making changes to tools, materials, and procedures as needed • Record **iterations** of prototyping	*Students will experience a minimum of three modules of Applied Design, Skills, and Technologies 6–7 in each of Grades 6 and 7. Schools may choose from among the modules listed below or develop new modules that use the Curricular Competencies of Applied Design, Skills, and Technologies 6–7 with locally developed content. Locally developed modules can be offered in addition to, or instead of, the modules in the provincial curriculum.* **Computational Thinking** *Students are expected to know the following:* • **simple algorithms** that reflect computational thinking • **visual representations** of problems and data • **evolution of programming languages** • **visual programming** **Computers and Communications Devices** *Students are expected to know the following:* • computer system architecture, including hardware and software, network infrastructure (local), intranet/Internet, and personal communication devices • strategies for identifying and troubleshooting simple hardware and software problems • function of input and output devices, including 3D printing and adaptive technologies for those with special needs • ergonomics in use of computers and computing devices • effective and efficient keyboarding techniques

Learning Standards (continued)

Curricular Competencies	Content
Testing • Test the first version of the product or the prototype • Gather peer and/or user and/or expert feedback and inspiration • Make changes, troubleshoot, and test again ***Making*** • Identify and use appropriate tools, **technologies**, and materials for production • Make a plan for production that includes key stages, and carry it out, making changes as needed • Use materials in ways that minimize waste ***Sharing*** • Decide on how and with whom to **share** their product • Demonstrate their product and describe their process, using appropriate terminology and providing reasons for their selected solution and modifications • Evaluate their product against their criteria and explain how it contributes to the individual, family, community, and/or environment • Reflect on their design thinking and processes, and evaluate their ability to work effectively both as individuals and collaboratively in a group, including their ability to share and maintain an efficient co-operative work space • Identify new design issues **Applied Skills** • Demonstrate an awareness of precautionary and emergency safety procedures in both physical and digital environments • Identify and evaluate the skills and skill levels needed, individually or as a group, in relation to a specific task, and develop them as needed	**Digital Literacy** *Students are expected to know the following:* • **Internet safety** • digital self-image, citizenship, relationships, and communication • legal and ethical considerations, including creative credit and copyright, and cyberbullying • methods for **personal media management** • search techniques, how search results are selected and ranked, and **criteria** for evaluating search results • strategies to identify **personal learning networks** **Drafting** *Students are expected to know the following:* • technical drawing, including sketching techniques and manual **drafting techniques** • elements of plans and drawings • simple computer-aided **drafting programs** **Entrepreneurship and Marketing** *Students are expected to know the following:* • role of entrepreneurship in designing and making products and services • **market niche** • branding of products, services, institutions, or places • pricing product/service, including decision to seek profit or break even • role of basic financial record-keeping and budgeting

Learning Standards (continued)

Curricular Competencies	Content
	Robotics *Students are expected to know the following:* • a robot is a machine capable of carrying out a complex series of actions automatically • uses of robotics • main components of robots: **sensors**, **control systems**, and **effectors** • various **ways** that objects can move • programming and logic for robotics components • various **platforms** for robotics
	Textiles *Students are expected to know the following:* • range of **uses** of textiles • variety of textile **materials** • **hand construction techniques** for producing and/or repairing textile items • consumer concerns that influence textile choices, including availability, cost, function (e.g., waterproof), and textile care
	Woodwork *Students are expected to know the following:* • ways in which wood is used in local cultural and economic contexts • characteristics of wood as a material • **woodworking techniques** and **basic joinery** using **hand tools**

Generating ideas

I build on others' ideas and add new ideas of my own, or combine other people's ideas in new ways to create new things or solve problems.

Collaborate to plan, carry out, and review constructions and activities

I ask and respond to questions.
I am an active listener.

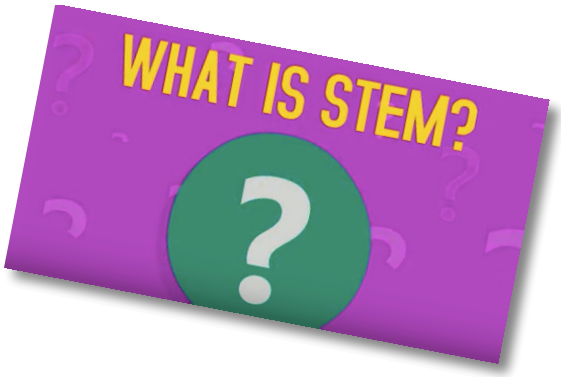
Quick video clips inspire Wonder

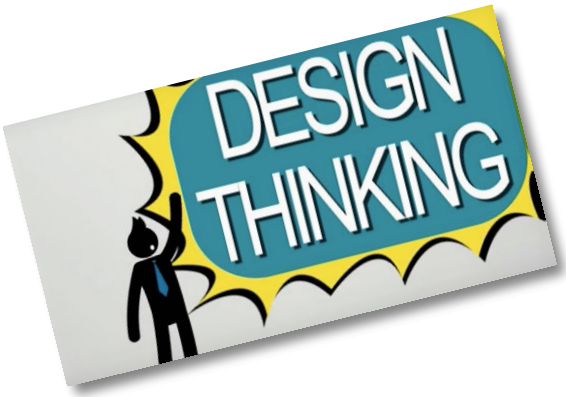
What is a MakerSpace? (1:02)

https://www.youtube.com/watch?v=NLEJLOB6fDw

What is STEM? (1:06, **stop at :34**)
https://www.youtube.com/watch?v=8yog11u8HTc

Why STEM? (1:00) *funny*
https://www.youtube.com/watch?v=8V8EjEzIpkg





What is Design Thinking? (1:50)

https://www.youtube.com/watch?v=a7sEoEvT8l8

7 Things That Happen When Students Own Their Learning (1:40)

https://www.youtube.com/watch?v=N7S9kyk-odA

What is Genius Hour? (1:42)

https://www.youtube.com/watch?v=2n7EelMbzG0

A Suggested Lesson Sequence

Week 1 - Guided Discovery: ***Discover and explore with Sphero***
Learning through play, students work in teams to discover and explore the unique functions of Sphero.

- *Roll* - Sphero is controlled by a person using a smartphone or tablet to manipulate Sphero's motor controls (the technology within) to play a game such as racing.

- *Colour Change* - you can change Sphero's colour! Sphero contains a unique RGB LED that allows thousands of possible colour changes. This comes in handy when you've got five or more Spheros playing simultaneously.

- *Physical Detection* - Sphero can detect objects in its path. Set up an obstacle course and explore this function.

- *Gesture* - Correctly match the colours on your screen by moving Sphero in the right direction.

- The *Input* function runs similarly to *Gesture*. Let Sphero be the game controller and manipulate orientation for certain types of game play.

- With the *Macro* function, commands become the main source of Sphero's game play; they generate movement, accomplishing your goal. *Blox* is the perfect example of this function. Drag and drop command "blox" into a timeline to program Sphero to work autonomously.

source: http://blog.sphero.com/blog/sphero-functions/

Use the following ***Sphero Lightning Lab Cheat Sheet*** to explore a checklist of different actions and tools - http://scottpantall.com/wp-content/uploads/2016/06/LightningLabCheatSheet.pdf
(Students could check off a list of actions and tools as they explore them.)

Week 2 - Guided Practice: ***Discover and explore drawing and coding with Sphero***
Suggested lessons and activities can be found at Sphero Edu:
https://edu.sphero.com/cwists/category

Students work in teams to:
- explore the draw canvas to draw shapes that represent code.
- write letters and spell words with Sphero, and navigate around obstacles to explore the surrounding space.
- draw different shapes and calculate the perimeter of each one: square, rectangle, and triangle.

- learn how to create programs using block coding, and gain an understanding of loops and operators.
- learn a new use for the lights on Sphero.
- explore the different variables of movement, direction, and speed with one bar of code.
- explore writing chains of code (writing a series of actions rather than one at a time).

Week 3 - Guided Practice - ***Explore coding and design challenges with Sphero***
Suggested activities can be found at Sphero Edu:
https://edu.sphero.com/cwists/category

*S*tudents work in teams to explore a design challenge:
- create a **Mini Golf** course which then can be played by coding a Sphero from the Tee to the Green. (Grades K-8).
- learn about speed, distance, velocity, as well as "if/and" statements and basic rules to the sport of **Curling**. (Grades K - 12+).
- design, construct and test **vehicles powered by Spheros**. (Grades K - 7).
- engineer **Sphero drawn chariots** and write code to compete in chariot races. (Grades 4 - 6).

Weeks 4-6 - Guided Application- ***Apply learning to a new context***
Students work in teams to plan, design and learn from their own design challenges or games, and then share their design challenges or games for other students to try.

- brainstorm design possibilities; generate potential ideas and choose an idea to pursue
- outline a general plan; identify tools and materials
- construct a first version of the design
- test the design, gather feedback and make changes
- construct the final design
- share with others - demonstrate and describe the process

Ideas to consider:
Learners capture and document their own learning process (using the devices they already have in their hands to operate the Sphero).

Student self assessment:
What did you learn today?
What worked? What was difficult? What will you try next time?
What do you wonder? What are you curious about now?

Drawing with Sphero

An introduction to the draw canvas and drawing shapes that represent code. Grades 1 - 3.

https://edu.sphero.com/cwists/preview/6872x

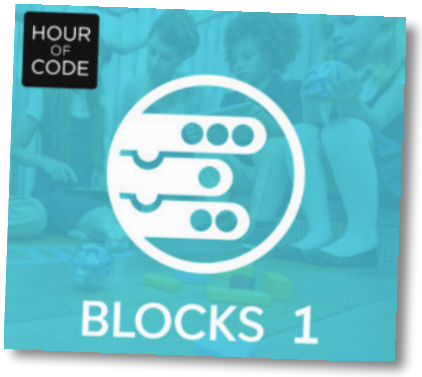
Spell letters and words with Sphero and then navigate around an obstacle to learn about the space around you. Grades 1 - 3.

https://edu.sphero.com/cwists/preview/6875x

Draw three different shapes and calculate the perimeter of each one: square, rectangle, and triangle. Grades 1- 3.

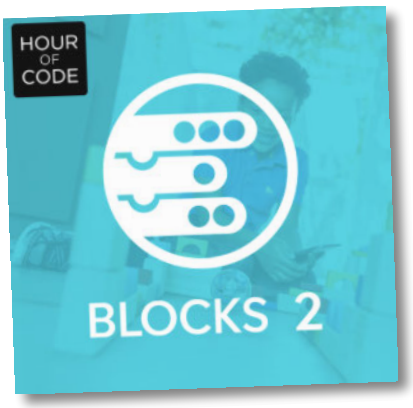
https://edu.sphero.com/cwists/preview/6920x

Block Coding with Sphero



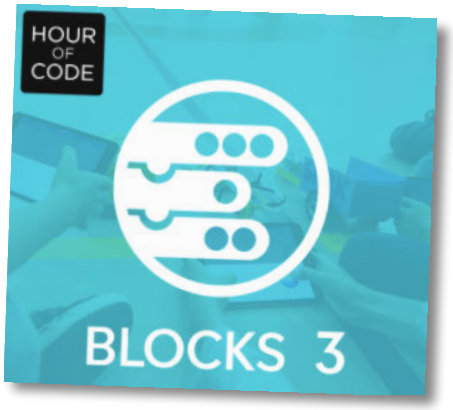
Students can follow these steps to get an overview of the Sphero Edu app, learn how to create programs using block coding, and gain an understanding of loops and operators. Grades 3 - 8.

https://edu.sphero.com/cwists/preview/1671x



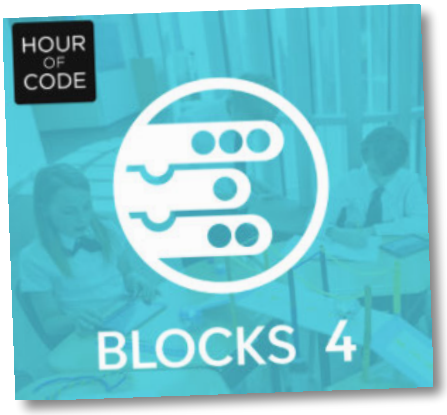
Students will learn about the "if/then, else" condition by building a fun game where they toss Sphero and guess animal sounds. Grades 1-6.

https://edu.sphero.com/cwists/preview/2143x



Students will learn a new use for the lights on the Sphero. In this activity, students will build a spinning top program where the gyroscopic spin rate will control the main LED's, and will use the concepts of normalization and absolute value. Grades 1 - 6.

https://edu.sphero.com/cwists/preview/2152x



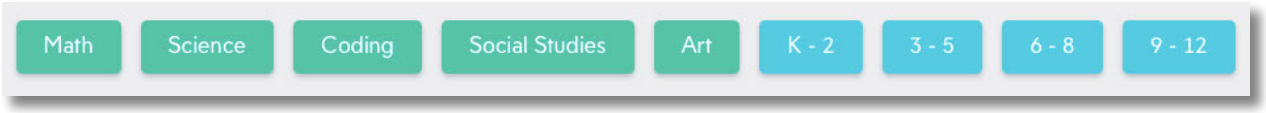
Students will explore variables to build a *hot potato* game powered by Sphero. They will also learn about ‘loop until’, and ‘randomness’ within bounds to bring this classic game to life. Grades 2 - 11.

https://edu.sphero.com/cwists/preview/6933x

Suggested Activities and Design Challenges

Discover all kinds of **amazing** lesson ideas and design challenges at **Sphero Edu.** Choose from a list of categories or explore the possibilities found on this page:

https://edu.sphero.com/cwists/category



Here are some design challenges we have discovered and are eager to explore with learners:

Sphero Mini Golf:
In this activity students collaborate to create a Mini Golf course which then can be played by coding a Sphero from the Tee to the Green. Grades K-8.

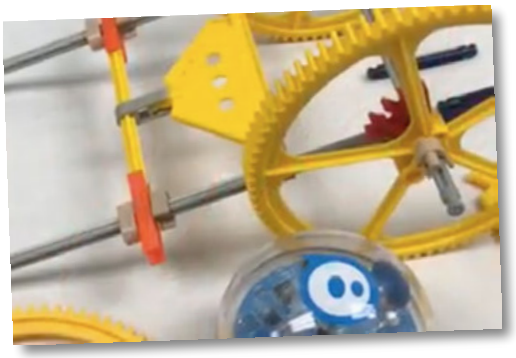
https://edu.sphero.com/cwists/preview/12702x

Olympic Curling with Sphero:
Students learn about speed, distance, velocity, as well as "if/and" statements and basic rules to the sport of Curling. Grades K - 12+.

https://edu.sphero.com/cwists/preview/12909x

This challenge, called *Project Vahana,* suggests using recyclable materials (cardboard, tape, skewers, cups, rubber bands, Pringles tubes, toothpicks) to design chariots. Grades K - 12+.

https://edu.sphero.com/cwists/preview/12921x



K'nex Chariot Challenge:
A design challenge where learners engineer Sphero drawn chariots and write code to compete in chariot races. Grades 4 - 6.

https://edu.sphero.com/cwists/preview/13271x

Crazy Robot Cars
In this activity students learn how to collaborate with others to design, construct and test vehicles powered by Spheros. Grades K - 7.

https://edu.sphero.com/cwists/preview/12699x

Lunar Maze Challenge - NASA has asked your team to navigate a rover in search of ice on the Moon for future human colonies! Program your rover to autonomously navigate the lunar maze. Grades 6 - 8.

https://edu.sphero.com/cwists/preview/13154x

Alien Pop
Students are given a cup and various building materials to create a way for the Sphero to drive the cup and pop balloons taped to a wall. Grades 4 - 12+.

https://edu.sphero.com/cwists/preview/13157x

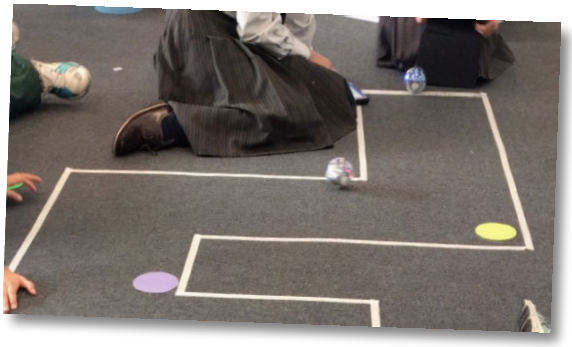
The Strolling Dead
Can Sphero navigate through a sea of meandering zombies to the hospital for much needed medical supplies? Can he then make it safely to the protection of camp without becoming infected? The survivors behind the gates won't wait for long and fresh supplies are your ticket in! Test your driving and coding skills in this multi-phase mission. Grades 5 - 12+.

https://edu.sphero.com/cwists/preview/4842x

Check out these websites for more activities and design challenge ideas:

Spheros in the Classroom shares Sphero lesson ideas involving mathematics, art, design and coding. Grades K - 3.

https://elenikyritsis.com/2016/08/20/spheros-in-the-classroom/



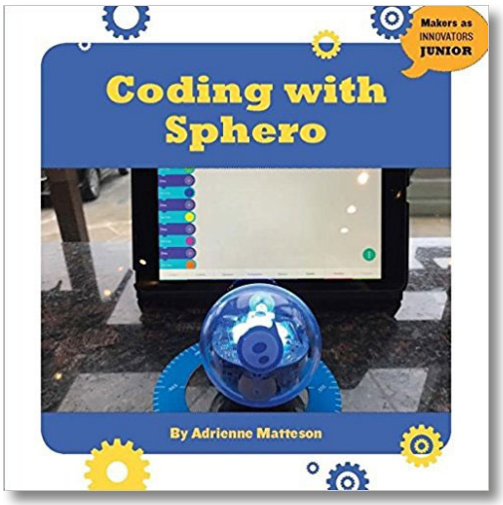
On Point for Kids shares a collection of visuals and ideas to inspire Sphero engineering and design challenges such as obstacle courses, chariot and competition ideas, and art ideas. Grades K - 6.

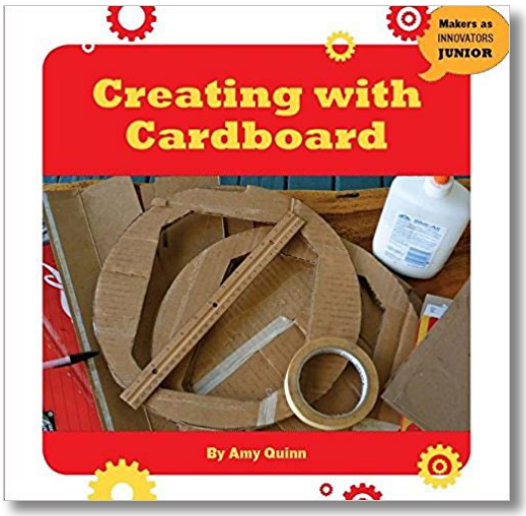
https://onpointforkids.com/2016/05/25/sphero-ideas-for-teachers/

Books to explore

With this book, students learn the art of innovation through detailed explanations and hands-on activities built to foster creativity and problem solving. Fun, engaging text introduces readers to new ideas and builds on maker-related concepts they may already know. Additional tools, including a glossary and an index, help students learn new vocabulary and locate information.

Sphero is a robotic ball that can be controlled using a tablet or smartphone. Through simple text written to foster creativity and problem solving, students will explore the art of innovation. Large, colourful images show students how to complete activities.

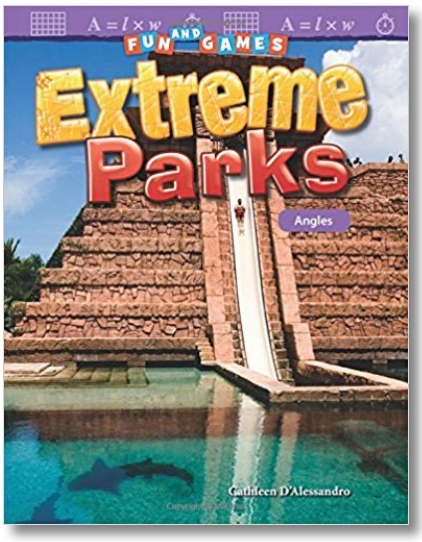


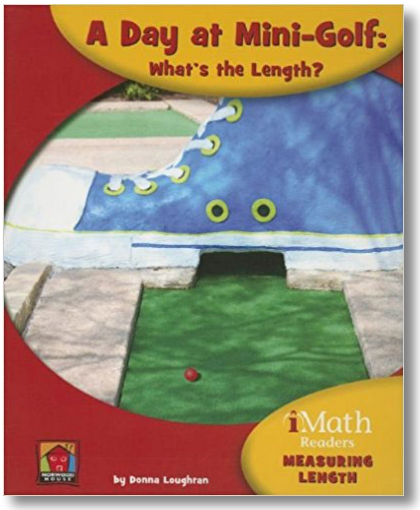


Simple, everyday cardboard can be a powerful tool for creating new things. Students can imagine and design environments for their Sphero ~ a maze, a race track, an obstacle course…

Books to explore

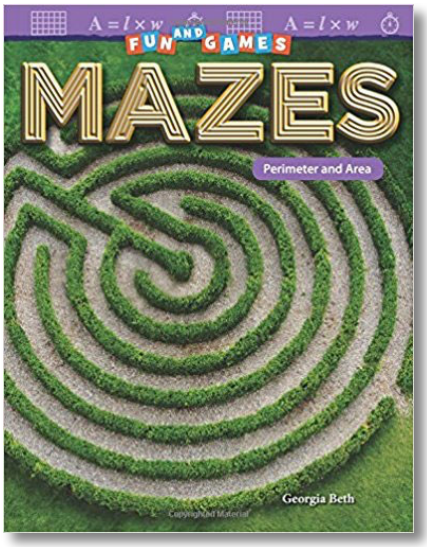
This book might inspire students to imagine designing extreme parks for their Sphero to find its way through ~ skate parks, water parks, amusement parks, future parks!



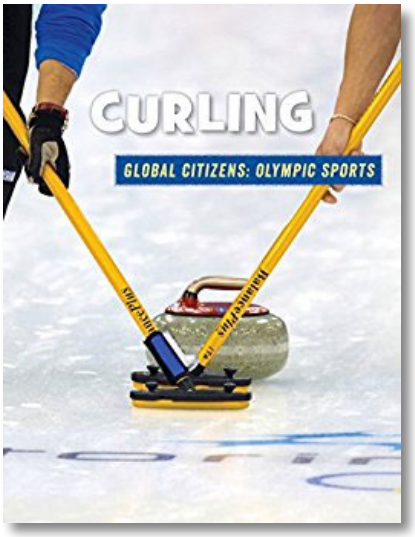


This book might inspire students to imagine designing a mini-golf course for their Sphero to find its way through.What is the distance from the tee to the cup for each hole? Students can determine the length of each hole by estimating length, expressing length units, and using measurement tools.

This book might inspire students to imagine designing a maze for their Sphero to find its way through. Every maze starts with a sketch on paper. Designers work out where to place the edges of their mazes.

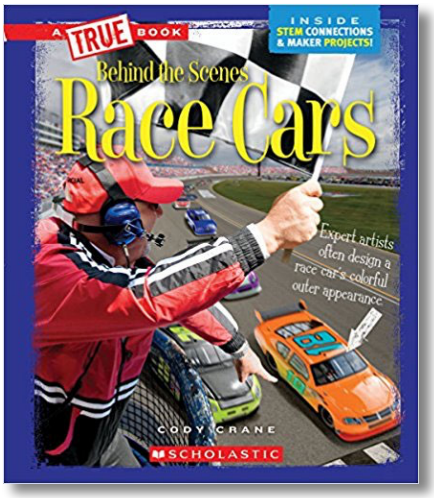


Books to explore



Curling in the Global Citizens: Olympic Sports series explores the sport through the lenses of History, Geography, Civics, and Economics. Text and photos look at the history, basic philosophies, and geography of curling.

This book describes the history, features, and future of Formula One cars and might inspire students to imagine designing a car shell for their Sphero to wear and race.



Race car technology has come a long way from the early days of auto racing. Todays cars rely on sleek, aerodynamic shapes and powerful engines to give drivers more speed and control than ever before.

Applied Design, Skills and Technologies "I" Statements:

I identify needs and opportunities for design through exploration.

I generate ideas from experiences and interests.

I choose an idea to pursue.

I go through a process of trial and error to make changes, solve problems and incorporate new ideas.

I reflect on my ability to work effectively both as an individual and collaboratively in a group.

Applied Design, Skills and Technologies Student Self-Assessment questions:

What inspires me to come up with new ideas?

What matters to me when I think about designing something?

How did/do my ideas change over the process of designing?

How do I refine my ideas?

How do my ideas contribute - to me, to my classmates, to the community?

How do I share my curiosity?

How best do I represent my understanding? What helps me to explain/recount and reflect on my learning?

What have I learned about being a Maker?

How did the design process go? What worked? What was difficult?

Where to next? What will I do differently next time?

A core competency I demonstrated was _____ because

I can identify skills required for a task and develop these skills as needed.

Emerging	**Developing**
Driving the Sphero ● I can adjust the speed level. ● I can change the colour and brightness. ● I can aim and calibrate the Sphero.	*Coding through drawing* ● I can create and name a program file. ● I can draw different shapes to instruct my Sphero. ● I can change the colour and brightness. ● I can aim and calibrate the Sphero. ● I can find and use the start and stop buttons. ● I can use the undo and redo arrows to make corrections.
Independent	**Extending**
Coding through Blocks ● I can create and name a program file. ● I can click and drag blocks into my program. ● I can drag a roll code block and change the different variables of speed, duration, and heading. ● I can chain together 6 or more blocks of code (a series of actions rather than one at a time). ● I can aim and calibrate the Sphero. ● I can find and use the start and stop buttons. ● I can use the undo and redo arrows to make corrections.	*Designing a Challenge* ● I can design Sphero challenges for others to attempt. ● I can apply my coding skills to explore challenges created by others. ● I can mentor others to block code with Sphero.

Student Self-Reflection:

Teacher Feedback:

Applied Design, Skills and Technologies Student Self-Assessment

What inspires me to come up with new ideas?

How did/do my ideas change over the process of designing?

How best do I share my curiosity?

How do my ideas contribute - to me, to my classmates, to the community?

Applied Design, Skills and Technologies Student Self-Assessment

What have I learned about being a design thinker?

How did the design process go? What worked? What was difficult?

Where to next? What will I / could I do differently next time?

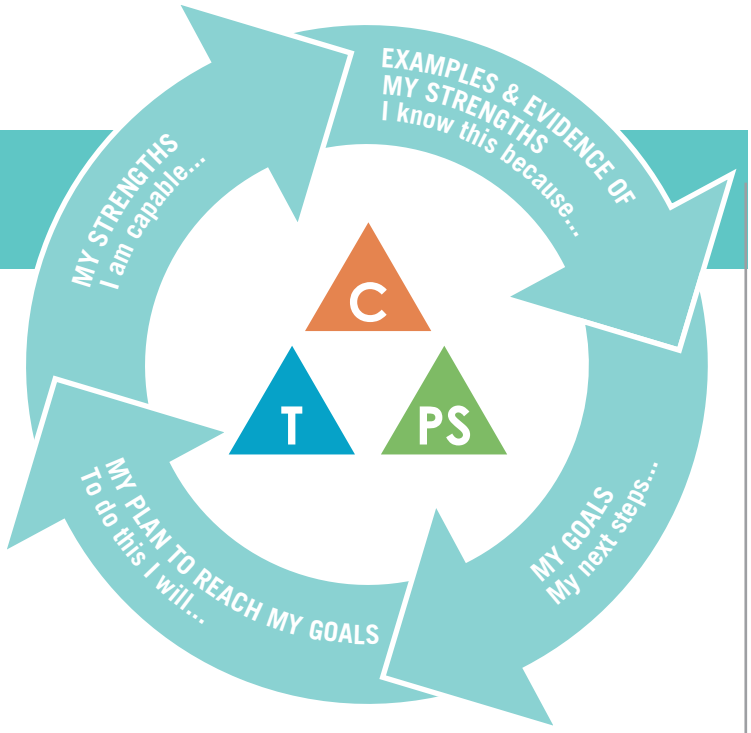
A core competency I demonstrated was

_____ *because*

CORE COMPETENCIES SELF-ASSESSMENT

Name: _____ Date: _____

I can reflect on my learning and describe or draw how I have demonstrated or developed my competencies.



Self-assessment can take many forms and may focus on one, a few, or all of the core competencies.

Adapted from School District No. 36, Surrey