Cubelets

Overall overview:

What are Cubelets?

Cubelets® Robot Blocks make it fast and easy to engage children as young as four in learning by building robots. There's no wrong way to build with Cubelets, so it easy to transform these blocks into brilliant bundles of robotic curiosity.

You don't need to know how to code or wire to construct robots with Cubelets. Snap the robot blocks together and the magnetic faces do the rest. Every unique arrangement is a new robot with novel behaviors emerging from the construction. Invention made easy.

Cubelets Brick Adapters let you pair with Lego® and other brick-based constructions to add new levels of detail and artistry to your robots. Brick Adapters come in two different styles, "studs" and "sockets" so you can build in any direction.

Ready to take your robots to the next level? Add a Bluetooth Cubelet to your construction to create responsive remote control robots or reprogram Cubelets to exhibit new behaviors.

It's never been easier to code your own Cubelets robot! Cubelets Blockly is the perfect platform to learn to program your own robots! This simple and powerful visual programming tool gives you full control over your Cubelets® robot blocks. Create countless new robots and behaviors with the power of code.

What is this kit for?

This kit can be utilized as an Intro to Robotics. Due to its ease of use, it can be introduced at a young age – as early as Kindergarten. Introductory lessons can be as simple or as complex as you want. Applications of the Cubelets to the various academic curricular areas are limited only by your creativity. Here is a list of examples of what could be done:

There are many applications that the Cubelets can be used for – some are obviously tied to specific curricular areas, while others could be adapted for use with specific ideas that the educator has developed in their classrooms.

- Drawing shapes using Cubelets – Math
- Ship transport from port to port – Social Studies
- Simulations of historical events – Social Studies
- Mars rover - Science
- Transport truck
- Mail service
- Vehicle races
- Scenario-based learning
- Combat simulations

In School District 71, there are futures in Robotics through several avenues; the Cubelets kit can be a great starting place. After introducing Robotics with this kit, students can take the next steps through any of the following routes:

- LEGO Mindstorms – literature and kits available in our district
- LEGO Robotopolis – literature available in our district
- VEX Robotics – Participated in through Robotics Teams in each high school
- ENTER Program – Run out of Highland Secondary School

In this kit is a list, with short descriptions, of several other supplementary materials that can help you build a robust Robotics lesson/unit/program.

Coding is another aspect to the ADST curriculum that can be explored through the Cubelets. As an introduction to coding, Cubelets is useful due to the intuitive nature of the block system and the Blockly platform, which allows the blocks to be programmed by the user. In addition to the ease of use as an introduction to coding, the Blockly platform allows for complexity and challenge for those students who are ready for more.

Children can use the Cubelet apps to control their robots using Blockly code. There are two apps that work with the cubelets:

Cubelets 4+
Modular Robotics
Free

"Cubelets robot blocks are a fast and easy way to inspire kids to become better thinkers.The Cubelets app connects to your Bluetooth Cubelet, and allows you to play with Cubelets in new ways. Connect to your Bluetooth Cubelet and see a map of your Cubelets update in real time as you change your construction. Then, select up to six Cubelets to remote control them. Steer your Drive blocks around, light up your Flashlight block, or read the output from the Distance blocks on your robot." (App Store description)

Cubelets Blockly 4+
Modular Robotics
Free

"Coding novices need not worry. Cubelets Blockly is the perfect platform to learn to program your own robots! This simple and powerful visual programming tool gives you full control over your Cubelets® robot blocks. Create countless new robots and behaviors with the power of code." (App Store description)

How to get started?

As the Cubelets are easy to use – they clip together nicely via their built-in magnetic faces – introducing them is as simple as giving the kids a set and letting them explore the functions of each block. A list of the blocks is provided in the kit, along with functional descriptions for each. Giving students the freedom to explore these blocks will often lead to unique products and creative ideas for what the Cubelet robots are capable of.

Alternatively, there is a set of tutorial lessons that students can work through, on the manufacturer's website:

https://www.modrobotics.com/cubelets/apps/cubelets-blockly/tutorials/

**See the 1st lesson in the Lesson Plans list for thoughts on applying this tutorial into your classroom*

Individual Lesson Plans:

Title: Cubelet Blockly Tutorials

Overview: A series of online tutorials provided by the manufacturer on their website. Helps to introduce the Cubelet blocks and what their functions are.

Learning Standards:

ADST Curriculum k-3:

- 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
- Develop their skills and add new ones through play and collaborative work
- Explore the use of simple, available tools and technologies to extend their capabilities

ADST Curriculum 4-5:

- Construct a first version of the product, making changes to tools, materials, and procedures as needed
- Test the product
- Make changes and test again, repeating until satisfied with the product
- Demonstrate a willingness to learn new technologies as needed

ADST Curriculum 6-8:

- Construct a first version of the product or a prototype, as appropriate, making changes to tools, materials, and procedures as needed
- 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
- Select, and as needed learn about, appropriate tools and technologies to extend their capability to complete a task

Prior Knowledge: Use of computer to find a webpage.

Materials:

You need to have access to computers

Tutorial Checklist

•1 x Battery Cubelet

•1 x Bluetooth Cubelet

•1 x Blocker Cubelet

•1 x Brightness Cubelet

•2 x Distance Cubelet

•2 x Drive Cubelet

•1 x Flashlight Cubelet

•1 x Passive Cubelet

Lesson: Students are tasked to work through the tutorials.

Warm Up (5 minutes): Introduce the Cubelet Tutorial by getting to the tutorial page, and do the 1st tutorial link (called Start HERE! Your first programmed robot)

Activity (30 minutes): Students use the following link to start the Cubelets Tutorial:

https://www.modrobotics.com/cubelets/apps/cubelets-blockly/tutorials/

As students work their way through the tutorials, they fill out the tutorial checklist. As the kit only has a limited number of blocks, groups should be utilized to share the equipment.

Wrap Up (10 minutes): Have students share what their favorite creation was – and explain specifically what blocks were required and how they combined to make the functional robot.

Extended Learning: Once completed, can you use the knowledge of what you have gained to make a novel robot using Cubelets blocks?

Evaluation: The tutorial checklist – could students describe what they were supposed to do for each tutorial module?

Cubelets Tutorial Checklist: ***Name_____***

Tutorial Name	***Description – what did you have to do?***	***Complete (yes/no)***
1 – A simple 1-line robot		
2 – Adding parts		
3 – Blinky		
4 – Blinky remix		
5 – Random wandering		
6 – Back that robot up		
7 – One step forward, one step back		
8 – Braitenblocks		
9 – Countdown to power down		
10 – Baseline		

11 – LO 10.29.1969		
12 – One thing leads to another		
13 – Rules + parts = behaviour		

Title: Bluetooth with Cubelets

Overview: Cubelets have Bluetooth capabilities, allowing for remote control of robots

Learning Standards:

ADST Curriculum 2-3:

- 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
- Develop their skills and add new ones through play and collaborative work
- Explore the use of simple, available tools and technologies to extend their capabilities

ADST Curriculum 4-5:

- Construct a first version of the product, making changes to tools, materials, and procedures as needed
- Test the product
- Make changes and test again, repeating until satisfied with the product
- Demonstrate a willingness to learn new technologies as needed

ADST Curriculum 6-8:

- Construct a first version of the product or a prototype, as appropriate, making changes to tools, materials, and procedures as needed
- 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
- Select, and as needed learn about, appropriate tools and technologies to extend their capability to complete a task

Prior Knowledge: Need to know how to use Cubelets to make robots

Materials:

You will need an iPad or a smartphone - download the relevant Bluetooth app from the following site, provided by the manufacturer:

https://www.modrobotics.com/cubelets/apps/

•1 x Battery Cubelet

•1 x Bluetooth Cubelet

•1 x Blocker Cubelet

•1 x Brightness Cubelet

•2 x Distance Cubelet

•2 x Drive Cubelet

•1 x Flashlight Cubelet

•1 x Passive Cubelet

Lesson: Using the video to introduce the activity, add Bluetooth ability to your robot creations

Warm Up (time): Have a student come up and make a simple robot that can move. Have the student describe how he made the robot and what it does.

After this, show the following video to the class, which details how to use Bluetooth with an iPad or smart phone to control their robot:

https://www.youtube.com/watch?v=cDNbjx9RFoE

Activity (time): Let students try out the Bluetooth adaptations of their robot creations. As the kit only has limited Bluetooth blocks, groups should be utilized to share the equipment.

Wrap Up (time): Ask a student (or students) to share what they have come up with

Extended Learning: Get all groups to work to create an elaborate set of robots that can be controlled using Bluetooth to perform some task or act.

Evaluation: Participation and presentation of results, informally.

Title: Getting Cubelet robots to follow a path

Overview: Using a white surface with black tape laid over it in some pathway, a Cubelet robot can be designed to follow the pathway

Learning Standards:

ADST Curriculum 2-3:

- 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
- Develop their skills and add new ones through play and collaborative work
- Explore the use of simple, available tools and technologies to extend their capabilities

ADST Curriculum 4-5:

- Construct a first version of the product, making changes to tools, materials, and procedures as needed
- Test the product
- Make changes and test again, repeating until satisfied with the product
- 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

ADST Curriculum 6-8:

- Construct a first version of the product or a prototype, as appropriate, making changes to tools, materials, and procedures as needed
- Test the first version of the product or the prototype
- Make changes, troubleshoot, and test again
- Select, and as needed learn about, appropriate tools and technologies to extend their capability to complete a task
- 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

Prior Knowledge: Need to know how to use Cubelets to make robots

When applying the techniques learned in this activity into extensions to other curricular areas, ensure that the students can talk about and utilize their prior knowledge in the proper context

Materials:

•Electricians' tape

•White surface (for example, a whiteboard)

•1 x Battery Cubelet

•1 x Blocker Cubelet

•1 x Bargraph Cubelet

•2 x Distance Cubelet

•2 x Drive Cubelet

•1 x Flashlight Cubelet

Lesson: Students can be taught to create a pathway for a Cubelet robot.

Warm Up (5 min): Show the following video to introduce the possibility of having robots follow a predetermined pathway:

https://www.youtube.com/watch?v=cUDPtNG5c24

Activity (20 min): After showing the video, give groups of students the materials required to test out this mechanism

Wrap Up (5 min): Ask the following questions: How does the Cubelet robot follow the path? What blocks allow it to do so?

Extended Learning: This property of Cubelet robots can be adapted for many uses across curriculum areas. Have students figure out where they can use this particular technique to display their learning in another area.

Examples of where this property could be used:

- Ship transport from port to port – Social Studies
- Simulations of historical events – Social Studies
- Mars rover - Science
- Transport truck
- Mail service

Evaluation: Evaluate the students' explanations for the questions in the wrap up … can they use the right terminology and theory to explain why the robot can follow the taped track?

Title: Wallstop

Overview: Another useful navigation technique, the Wallstop can be used to direct the motion of Cubelet robots

Learning Standards:

ADST Curriculum 2-3:

- 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
- Develop their skills and add new ones through play and collaborative work
- Explore the use of simple, available tools and technologies to extend their capabilities

ADST Curriculum 4-5:

- Construct a first version of the product, making changes to tools, materials, and procedures as needed
- Test the product
- Make changes and test again, repeating until satisfied with the product
- 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

ADST Curriculum 6-8:

- Construct a first version of the product or a prototype, as appropriate, making changes to tools, materials, and procedures as needed
- Test the first version of the product or the prototype
- Make changes, troubleshoot, and test again
- Select, and as needed learn about, appropriate tools and technologies to extend their capability to complete a task
- 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

Prior Knowledge: Need to know how to use Cubelets to make robots

Materials:

•1 x Battery Cubelet

•1 x Brightness Cubelet

•1 x Distance Cubelet

•2 x Drive Cubelet

•1 x Inverse Cubelet

•1 x Passive Cubelet

Lesson: Using the distance Cubelet with an Inverse Cubelet allows robots to detect obstacles and boundaries

Warm Up (5 min): Show the following video to introduce the possibility of having robots follow a predetermined pathway:

Activity (20 min): After showing the video, give groups of students the materials required to test out this mechanism

Wrap Up (5 min): Have students answer the following question: "Where in society is the "Wallstop" used to help humans perform a task?"

Extended Learning: Have students try to make a maze that the Cubelet robot will follow.

Evaluation: Look for comprehension regarding the wrap up question – can students think of anything?

Title: Robo Warrior

Overview: Robot fights can be simulated using Cubelets

Learning Standards:

ADST Curriculum 4-5:

- Construct a first version of the product, making changes to tools, materials, and procedures as needed
- Test the product
- Make changes and test again, repeating until satisfied with the product
- 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

ADST Curriculum 6-8:

- Construct a first version of the product or a prototype, as appropriate, making changes to tools, materials, and procedures as needed
- Test the first version of the product or the prototype
- Make changes, troubleshoot, and test again
- Select, and as needed learn about, appropriate tools and technologies to extend their capability to complete a task
- 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

Prior Knowledge: The ability to follow instructions to make a Cubelet robot

Materials:

•2 x Battery Cubelet

•2 x Blocker Cubelet

•2 x Distance Cubelet

•2 x Drive Cubelet

•2 x LEGO Adaptor

•LEGO Blocks

Lesson: Mobile Cubelet robots can engage in “battles” – can students make a robot that will be an effective Robo Warrior?

Be sure to build in a discussion of Sportsmanship and composure when engaging in this activity

Warm Up (5 min): Show the following video to introduce the Robo Warrior robot fighting competition.

Activity (20 min): After showing the video, give groups of students the materials required to create Robo Warriors

Wrap Up (20 min): Have Robot fighting competitions, with the crowd judging winners between Robo Warrior contestants

Extended Learning: Compare designs and determine why individual Robo Warriors were better at "fighting" than others

Evaluation: Create a rubric or use the rubric below to help you determine the effectiveness of students in navigating the complexities of Robo Warrior competitions – it would be a good idea to discuss what being "sportsmanlike" or "unsportsmanlike" would look like before the competition.

Robo Warrior Rubric:

CATEGORY	1	2	3
Completion	Did not make a Robo Warrior	Made a Robo Warrior that couldn't "fight"	Robo Warrior was functional and able to participate in a "fight"
Creativity	Copied the video example OR didn't make a Robo Warrior	Made a Robo Warrior	Robo Warrior looks unique and moves in a unique way
Sportsmanship	Displays a lack of sportsmanship (mean to others, not cooperative, not gracious in defeat or victory)	Shows sportsmanship generally, but had a slip-up at some point	Was a sportsmanlike participant (was gracious in victory or positive in defeat)

Title: Robot Building Challenge

Overview: Students are to recreate some simple Cubelet robots, then use their properties to inform their design of a novel robot

Learning Standards:

ADST Curriculum 4-5:

- Construct a first version of the product, making changes to tools, materials, and procedures as needed
- Test the product
- Make changes and test again, repeating until satisfied with the product
- 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

ADST Curriculum 6-8:

- Construct a first version of the product or a prototype, as appropriate, making changes to tools, materials, and procedures as needed
- Test the first version of the product or the prototype
- Make changes, troubleshoot, and test again
- Select, and as needed learn about, appropriate tools and technologies to extend their capability to complete a task
- 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

Prior Knowledge: The ability to follow instructions to make Cubelet robots

Materials: listed for each robot to be constructed:

For Lighthouse:

•1 x Battery Cubelet

•1 x Inverse Cubelet

•1 x Passive Cubelet

•1 x Knob Cubelet

•1 x Rotate Cubelet

•1 x Flashlight Cubelet

•2 x LEGO Adaptor

•LEGO Blocks

For Code a Pillar:

•1 x Battery Cubelet

•1 x Brightness Cubelet

•1 x Drive Cubelet

•1 x Flashlight Cubelet

•1 x Passive Cubelet

•5 x LEGO Adaptor

•LEGO Blocks

For Wobbli Racer:

•1 x Battery Cubelet

•1 x Distance Cubelet

•1 x Drive Cubelet

•1 x Flashlight Cubelet

•1 x Passive Cubelet

•1 x LEGO Adaptor

•LEGO Blocks

Lesson: Students can easily recreate other robots – can they make their own, unique creation??

Warm Up (5 min): Ask the following 2 questions:

1) What skills are needed to follow instructions to recreate someone else's design?
2) What skills are needed to create a unique functional invention?

Activity (40 min):

Part One – Lighthouse – 10 min

1) Show Lighthouse video (https://www.youtube.com/watch?v=Yf3l2ZyTqzs)
2) Give students materials to create Lighthouse
3) Compare constructions with video Lighthouse

Part Two – Code a Pillar – 10 min

1) Show Code a Pillar video (https://www.youtube.com/watch?v=sx8O60nSykg)
2) Give students materials to create Code a Pillar
3) Compare constructions with video Code a Pillar

Part Three – Wobbli Racer – 10 min

1) Show Wobbli Racer video (https://www.youtube.com/watch?v=NHE_7BrX_jw)
2) Give students material sto create Wobbli Racer
3) Compare constructions with video Wobbli Racer

Part Four – Create your own Functional Robot – 10 min

1) Give kids all blocks back
2) Give them time to create their own functional robots
3) Have them test them out and figure out the function of their design

Wrap Up (15 min): Have student groups present their creations

Extended Learning: Ask the question:

"What would you like to have to help you do something?"

Can students design a Cubelet robot to help you?

Evaluation: Use the table below to help you evaluate the kids' work on this activity:

Task	***Exact Replica (yes/no)***	***Function of the robot?***
Lighthouse		
Code a Pillar		
Wobbli Racer		
Unique Design	Complete: YES or NO	