

WeDo 2.0

MAKER Activities - Elementary

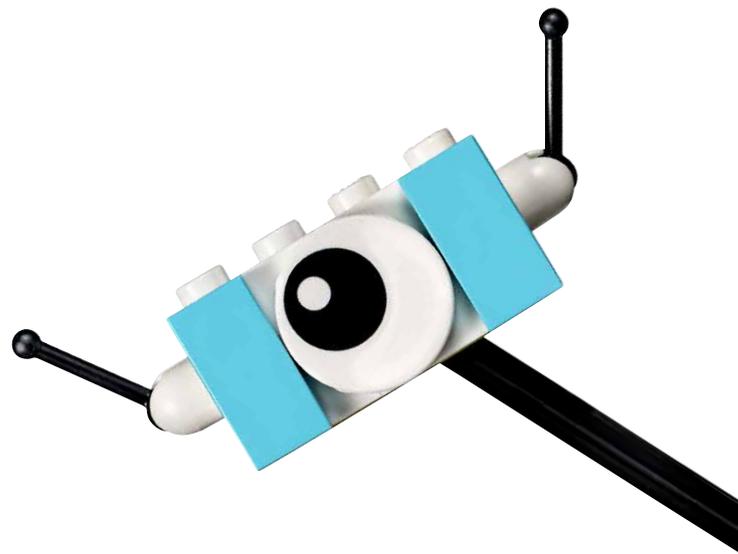
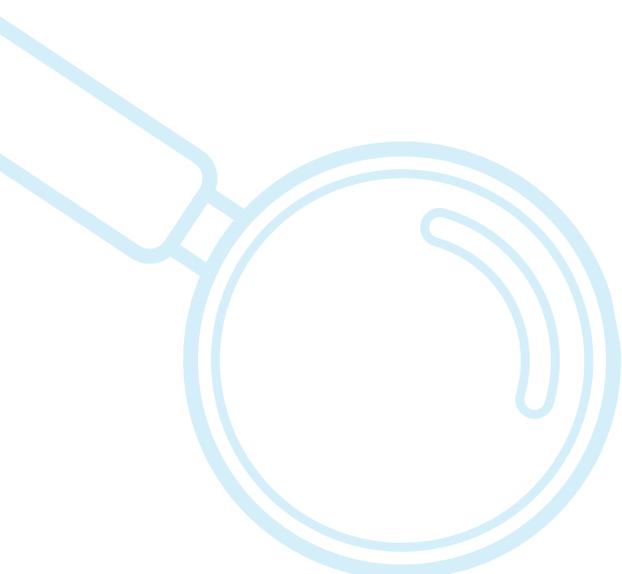
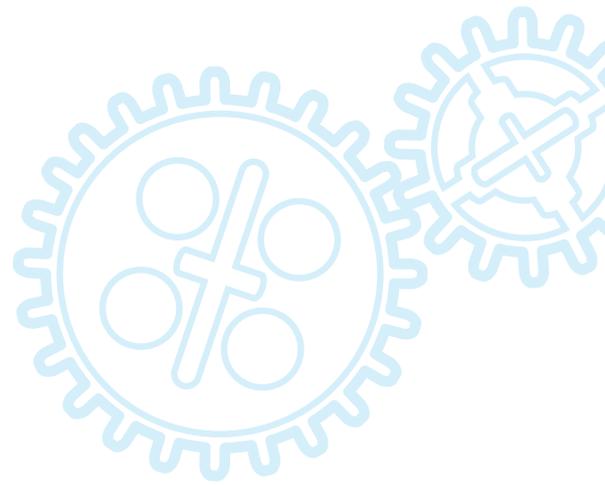




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Introduction to the Maker Lessons



The LEGO® Education WeDo 2.0 Maker lessons have been developed to engage and motivate elementary school students, piquing their interest in learning design, engineering, and coding using motorized models and simple programming.

Each lesson provides an initial brief as a starting point. The open-ended prompts allow for unlimited answers and enable students to express a wide range of creative solutions as they sketch, build, and test prototypes of the designs they create.

The teacher's role in these lessons is to provide students with the tools and necessary freedom to connect with and define a problem, make a solution, and share what they have made.

Use your creativity to adapt these lessons to suit the needs of your students.

“The role of the teacher is to create the conditions for invention rather than provide ready-made knowledge.”

– Seymour Papert

Classroom Management Tips

Required Materials

- LEGO® Education WeDo 2.0 Core Set
- Lesson plan
- Student Worksheet for each lesson
- Modeling materials already available in your classroom

How much time do you need?

Each lesson is designed to take 90 minutes. If you work in shorter class periods, you can break this down into two 45 minute sessions.

Preparation

It is important to establish student groups. Groups of two work well. Ensure that each student has a copy of the Student Worksheet for recording their design process, or alternatively, they can use their own preferred method for recording their design journey. They will also need the LEGO Education WeDo 2.0 Core Set (one set for every two students is recommended).

Prior Learning

Before beginning these Maker lessons, it is recommended that students complete at least one of the Getting Started lessons with Milo the Science Rover, and spend some time tinkering and playing with the WeDo 2.0 LEGO® bricks and programming app. These lessons, which can be found within the WeDo 2.0 software, will build students' competence and confidence in building and coding.

However, if you prefer a more open-ended, explorative approach, you can start out with this lesson and allow students to find help on their own by exploring the WeDo 2.0 Model and Program Libraries.

The LEGO® Education Maker (Design) Process



Find a Problem

It is important that students define a real problem to solve or find a new design opportunity from the start. The Connect images are provided as inspiration to help students as they begin thinking about their own design solutions.



Brainstorm

Brainstorming is an active part of making. Some students will find it easier to explore their thoughts through tinkering (hands-on experimentation) with the LEGO bricks, and others through recording sketches and notes. Group work is essential, but it is important to allow time for students to work alone before sharing their ideas with their group.



Choose the Best Idea

Discussing and finding an agreement about the best solution to build can involve a lot of negotiation, and may require different techniques depending on the student's skills. For example:

- Some students draw well.
- Others may build part of a model, and then describe what they mean.
- Other students may be good at describing a strategy.



Encourage a culture in which students can share anything, no matter how abstract it might sound. Be active during this phase and ensure that the ideas the students choose are achievable.

It is important that students set clear design criteria. Once the solution to the problem has been made, the students will return to these criteria, which will then form the basis for testing how well the solution works.



Go Make

Students must make one of the ideas using the LEGO® set, and can use other materials if needed. If they are finding it hard to build their idea, encourage them to break problems down into smaller parts. Explain that they do not have to come up with the whole solution from the start. Remind students that this process is iterative and they must test, analyze and revise their idea as they go.

Using this Maker process does not mean you are following an inflexible set of steps. Instead, think of it as a set of practices.

For example, brainstorming may be prominent at the beginning of the process. However, students may also need to brainstorm ideas when they are trying to figure out ways to improve their idea, or when they have a bad test result and they must change some feature of their design.



Evaluate What You Have Made

To help students develop their critical thinking and communication skills, you may wish to have students from one group observe and critique the solution from another group's solution. Peer review and formative feedback helps both the students giving and the students receiving the feedback to improve their work.



Present Your Model

The Student Worksheet is helpful for basic documentation of the lesson. Students can also refer to it when presenting their work in front of the class. You may also wish to use the Student Worksheet as a portfolio for performance evaluations or for student self-evaluation.

Assessment

Where can I find the assessment materials?

Assessment materials are provided at the end of the Student Worksheet for the first three projects.

What learning goals are assessed?

Students use the Maker self-assessment rubric to evaluate their design work. Each rubric includes four levels of achievement. The intention is to help students reflect on what they have done well and what they could have done better. Each rubric can be linked to engineering-related learning goals.

Using these rubrics, students assess themselves according to the 'Four Bricks Scale' in which the biggest brick represents the highest rating. In certain situations, you might consider asking your students to assess themselves using only two of the four bricks.



Design criteria example:
The design must..
The design should..
The design could..



Emerging

The student is at the beginning stages of development in terms of content knowledge, ability to understand and apply content, and/or demonstration of coherent thoughts about a given topic.

Developing

The student is able to present basic knowledge only (e.g., vocabulary), and cannot yet apply content knowledge or demonstrate comprehension of the concepts being presented.

Proficient

The student has concrete levels of comprehension of the content and concepts, and can demonstrate adequately the topics, content, or concepts being taught. The ability to discuss and apply concepts outside of the required assignment is lacking.

Accomplished

The student can take concepts and ideas to the next level, apply concepts to other situations, and synthesize, apply, and extend knowledge to discussions that include extensions of ideas.

NGSS Science Standards:

Science and Engineering Practices
3-5-ETS1.1, 3-5-ETS1-2, 3-5-ETS1-3

Disciplinary Core Ideas
ETS1.A, (3-5-ETS1-1)
ETS1.B, (3-5-ETS1-2), (3-5-ETS1-3)
ETS1.C, (3-5-ETS1-3)

Common Core State Standards

ELA/Literacy
RI.5.1, RI.5.7, W.5.8

Mathematics
MP.2, MP.4

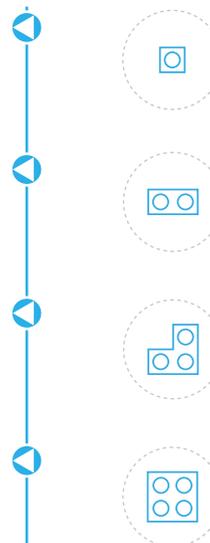
Share It

We encourage you to share your students' brilliant projects on the appropriate social media platforms using the hashtag #LEGOMaker.

The Maker Lessons

Start your Maker journey with the following three lessons:

- Make a sound machine
- Make a dancing robot
- Make a Life Hack



 **#LEGOMAKER**

The LEGO® Education Maker (Design) Process



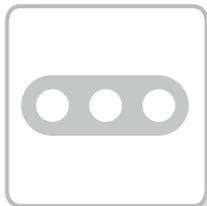
Find a Problem



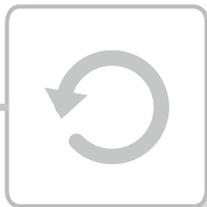
Brainstorming



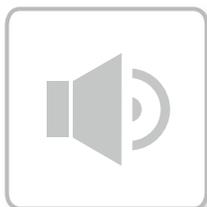
Choose the Best Idea



Go Make



Evaluate What You Have Made



Present Your Model

Make a Sound Machine

This is a highly-engaging Maker lesson that will create some joyful noise! Have students explore programming variables that make soft sounds, loud sounds, environmental sounds, rhythms, and melodies. Students can even combine projects to make a band.

Learning Goals

After completing this lesson, students will have:

- Used and understood the design process
- Defined a clear design need
- Developed their ability to iterate and improve design solutions
- Developed their problem-solving and communication skills

Duration

2 x 45 min (90 min)

Preparation

Ensure that each student has a copy of the Student Worksheet for recording their design process. They will also need the LEGO® Education WeDo 2.0 Core Set (one set for every two students is recommended).

Other Materials Required (Optional)

Use craft materials that you already have in your classroom to add another dimension to this lesson. Some materials could be:

- Rubber bands
- Pipe cleaners
- Small musical instruments (e.g., xylophone, tambourine, jingle bells, cymbals, drums, maracas, rainstick)
- Plastic or paper cups
- Keys, or other metal objects
- Recycled materials and objects from nature

Procedure

1. Introduction/Discussion

Hand out the Student Worksheets and allow the students to interpret the lesson themselves, or read the Maker Connect text aloud to set the scene.

2. Find a Problem

As students look at the “connect” images and questions, facilitate a discussion to steer them toward a problem or new design opportunity. Once they have decided upon a problem to solve, ensure that they record this in some way. They can use the worksheet to help structure their project documentation or use their own preferred method to record their design journey.

3. Brainstorm

Students should initially work independently or in pairs, spending a few minutes to generate as many ideas as they can to solve the problem. They can use the bricks from the LEGO® set during the brainstorming process, or sketch out their ideas in the space provided on the worksheet.



It is important for students to spend time tinkering with the LEGO® bricks in order to generate ideas. The goal of tinkering is to explore as many solutions as possible. You can use the tinkering examples at the end of these materials for inspiration, or as a means for getting started.

Students can now take turns sharing their ideas within their groups. Once all of the ideas have been shared, each group should select the best idea(s) to make. Be prepared to help facilitate this process, ensuring that the students choose an idea that is possible to make. Encourage diversity, not all groups have to make the same thing.

4. Choose the Best Idea

Students should record up to three design criteria on their worksheets. They will refer to this again as they review and revise their solutions.

5. Go Make

Let the students carry out one of their group's ideas using WeDo 2.0 and other materials as needed. Reinforce that students do not have to come up with the whole solution from the start.

During the making process, remind students to test and analyze their idea as they go, making improvements where necessary. If you want students to submit their documentation at the end of the lesson, ensure that they use sketches and photos of their models to record their design journey during the making stage of the lesson.

6. Evaluate What You Have Made

Students will test and evaluate their designs against the design criteria they recorded before they started making their solutions. They can record notes on their Student Worksheets.

7. Present Your Model

Allow time for each student or student group to present what they have made to the class. A good way to do this is to set out a table large enough to display all of the models. If time is short, pair off the groups and have them present to each other.

8. Assessment

Students will use the Student Worksheet assessment rubric to evaluate their design work according to the 'Four Bricks Scale'.

9. Tidy Up

Ensure that you leave approximately 10-15 minutes at the end of the lesson to break down the models and sort them back into the LEGO® boxes.

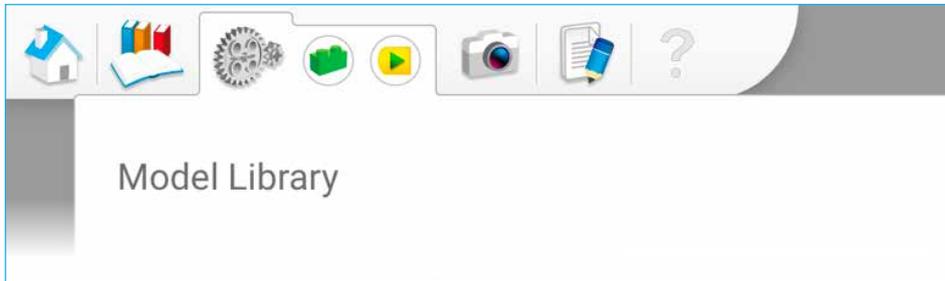
Take turns to share your ideas.



Tinkering Examples

Some students may need a little inspiration and scaffolding to help them get started.

Students can explore the Model Library to find inspiration for the different types of sound machines they can make. By asking questions (e.g., Do you want to make a sound machine that taps a beat or shakes an object?), you can help lead the students to relevant models based on their ideas. Students can remix their models by adding or removing LEGO® elements and other objects.

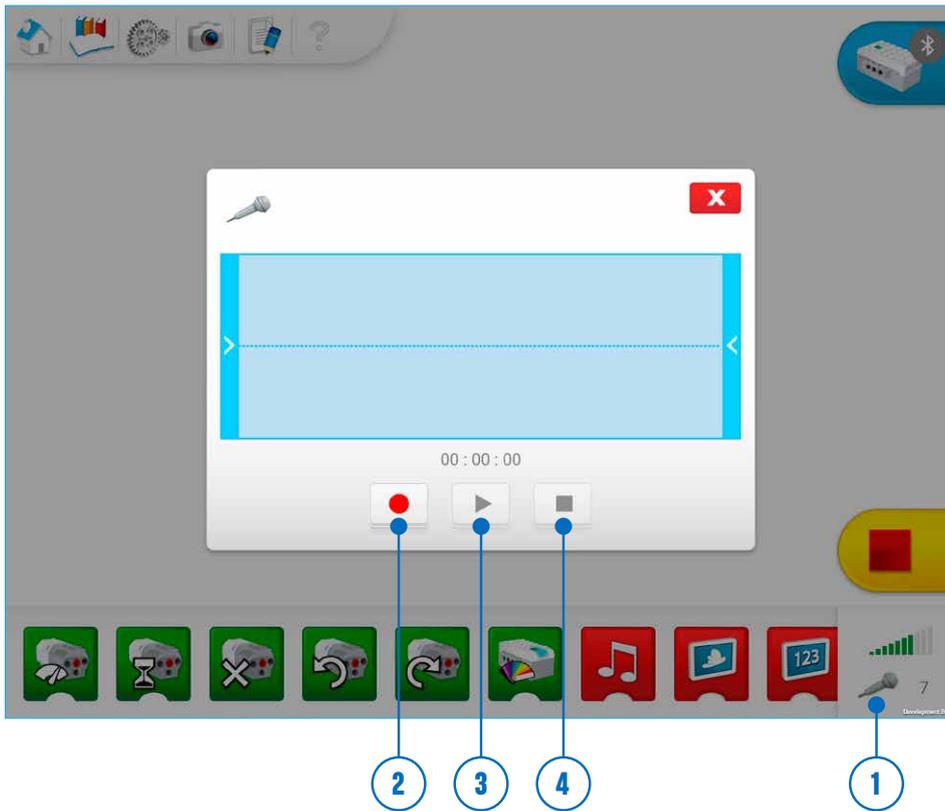


Combining the WeDo 2.0 Smarhub with a sensor, the sound library makes a simple introductory sound machine with many possibilities. Students can also record and play a custom sound or melody.



Programming note:

Students can record their own sounds to use with their sound machines.

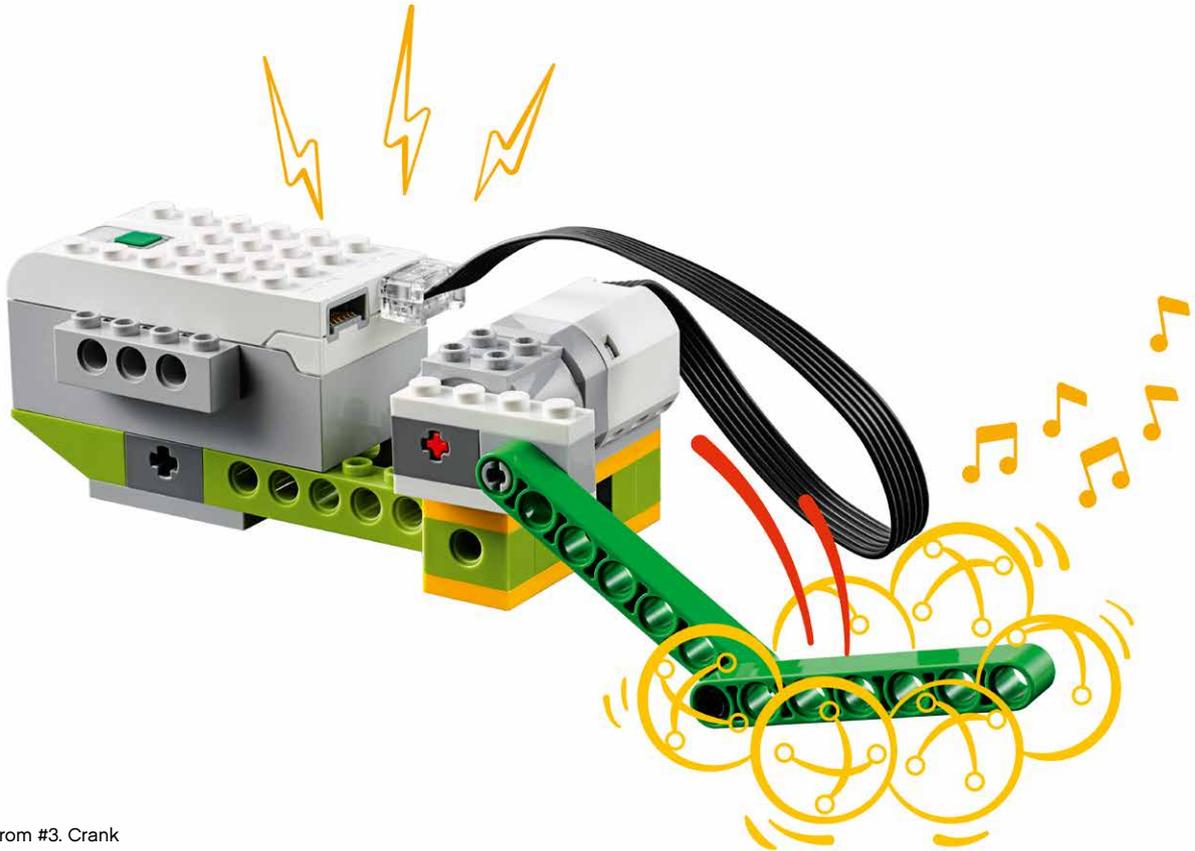


1. Press the Mic icon to access the window.
2. Press the Record icon to begin recording.
3. Press the Play icon to play back the recording.
4. Press the Stop icon to stop the recording.

The last recorded sound will be saved in a Sound Block with the input "0."

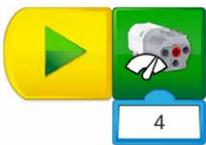


Sample model

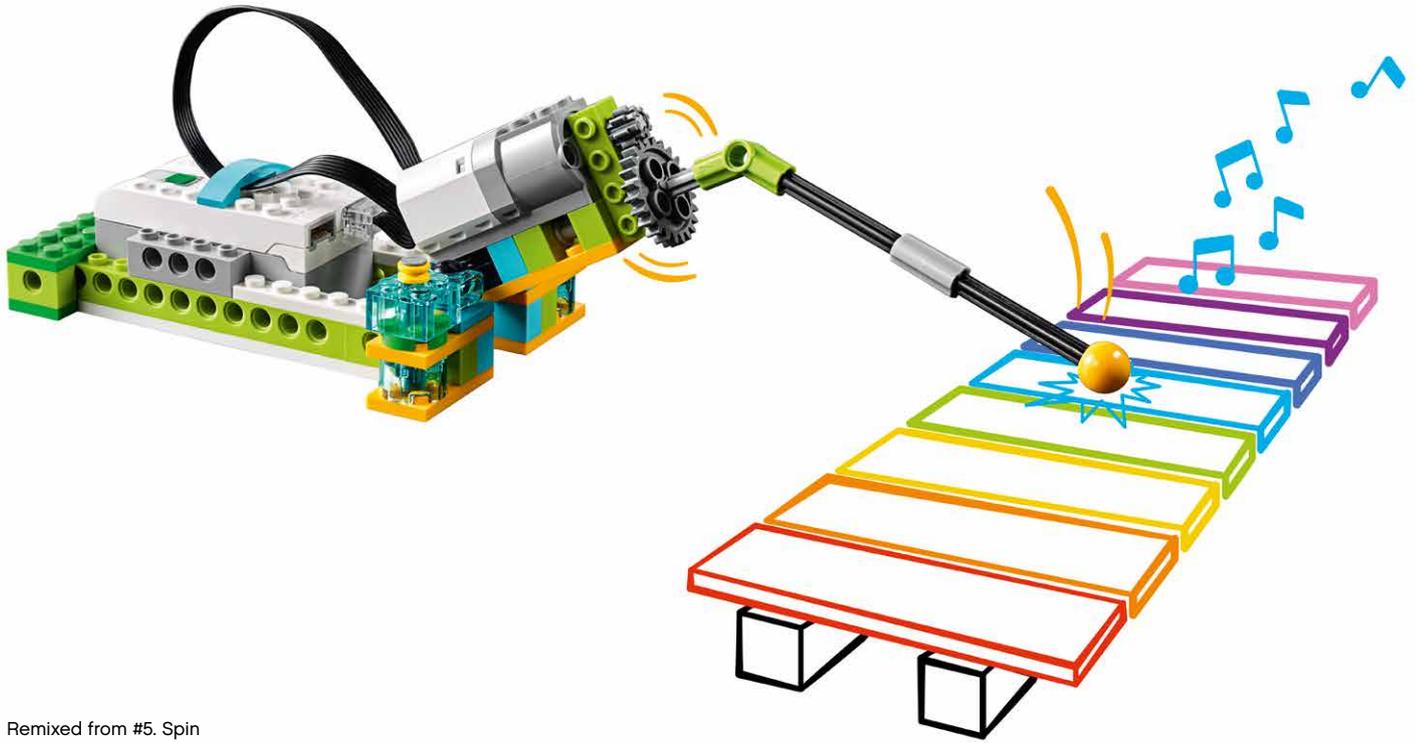


Remixed from #3. Crank

Sample program



Sample model



Remixed from #5. Spin

Sample program



Make a Sound Machine

Maker Connect

Close your eyes and listen. Sounds are all around us! Where can you hear sounds coming from?

Sounds come from nature, animals, objects, and machines. Sounds can make rhythms, and sounds can make music. Sounds can wake you up, warn you of danger, or entertain you. Sometimes sounds are just noise.

Look at the photos, then think about these questions.

- What do you see?
- What questions do you have?
- What ideas do you have?
- What can you make?
- Can you make your own sound machine?



Student Worksheet:

Make a Sound Machine

Name(s): _____ Date: _____

Find a Problem

What ideas came to mind when you saw the pictures?

Brainstorm

Individual work: Now that you have found a problem, take three minutes to come up with ideas for solving it. Be prepared to share your ideas with your group.

Group work: Share and discuss your ideas for solving the problem.



Record as much as you can through sketches, photos and notes.



Use LEGO® bricks and sketches to explore your ideas.



Sometimes simple ideas are the best ideas.



Choose the Best Idea

You should have come up with a number of ideas. Now choose the best one to make.

Write down three things your design must be able to do:

- 1. _____
- 2. _____
- 3. _____

Go Make

It is time to start making. Use parts from the LEGO® set to make your chosen idea. Test your design as you go and record any changes that you make.

Evaluate What You Have Made

Have you solved the problem that you found at the start of the lesson? Look back at the things you said your design must be able to do.

How well does your solution work? Suggest three things you could do better.

- 1. _____
- 2. _____
- 3. _____

Present Your Model

Now that you have finished, make a sketch or take a photo of your model, label the three most important parts, and explain how they work. You are now ready to present your model to the class.

Well done! What will you make next?



Three things your design must do.
Example:
The design must..
The design should..
The design could..



You can use other materials from around the classroom.



Print your photos and attach all of your work to a legal size sheet of paper or card stock.



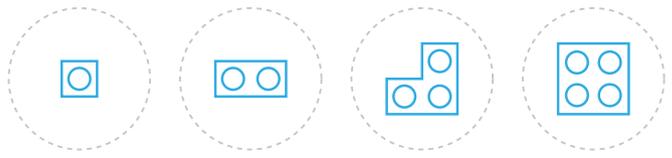
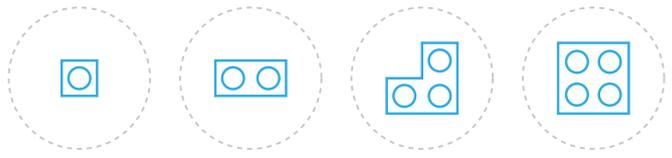
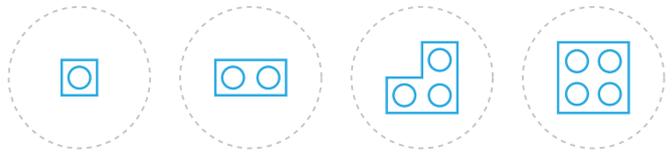
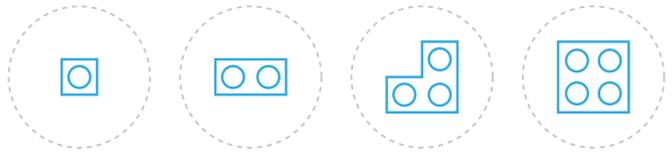
Self Assessment

Student Name: _____

Date: _____

How did you do?

Directions: Circle the brick that shows how well you did. The bigger brick, the better you did.

<p>We built and tested one design or more based upon a problem we found.</p>	
<p>We joined ideas to build a good solution to a problem we found.</p>	
<p>We made our idea better based on our tests.</p>	
<p>The final design was able to do everything it was supposed to do.</p>	

Describe what you did (draw, write or add a photo):

Tell someone about the problem you solved...

Make a Dancing Robot

This Maker lesson includes a whole range of possible Dancing Robot designs and performances. Students can explore a cultural dance, tell a story through dance, dance in pairs or groups, or even plan a dance party where WeDo 2.0 robots are more than just dancers!

Learning Goals

After completing this lesson, students will have:

- Used and understood the design process
- Defined a clear design need
- Developed their ability to iterate and improve design solutions
- Developed their problem-solving and communication skills

Duration

2 x 45 min (90 min)

Preparation

Ensure that each student has a copy of the Student Worksheet for recording their design process. They will also need the LEGO® Education WeDo 2.0 Core Set (one set for every two students is recommended).

Other Materials Required (Optional)

Use craft materials that you already have in your classroom to add another dimension to this lesson. Some materials could be:

- Plastic or paper cups
- Cardboard boxes
- Egg cartons
- Fabric or Felt
- Foam, pom-poms, or beads
- Pipe cleaners

Procedure

1. Introduction/Discussion

Hand out the Student Worksheets and allow the students to interpret the lesson themselves, or read the Maker Connect text aloud to set the scene.

2. Find a Problem

As students look at the “connect” images and questions, facilitate a discussion to steer them toward a problem or new design opportunity. Once they have decided upon a problem to solve, ensure that they record this in some way. They can use the worksheet to help structure their project documentation or use their own preferred method to record their design journey.

3. Brainstorm

Students should initially work independently or in pairs, spending a few minutes to generate as many ideas as they can to solve the problem. They can use the bricks from the LEGO® set during the brainstorming process, or sketch out their ideas in the space provided on the worksheet.



It is important for students to spend time tinkering with the LEGO® bricks in order to generate ideas. The goal of tinkering is to explore as many solutions as possible. You can use the tinkering examples at the end of these materials for inspiration, or as a means for getting started.

Students can now take turns sharing their ideas within their groups. Once all of the ideas have been shared, each group should select the best idea(s) to make. Be prepared to help facilitate this process, ensuring that the students choose an idea that is possible to make. Encourage diversity, not all groups have to make the same thing.

4. Choose the Best Idea

Students should record up to three design criteria on their worksheets. They will refer to this again as they review and revise their solutions.

5. Go Make

Let the students carry out one of their group's ideas using WeDo 2.0 and other materials as needed. Reinforce that students do not have to come up with the whole solution from the start.

During the making process, remind students to test and analyze their idea as they go, making improvements where necessary. If you want students to submit their documentation at the end of the lesson, ensure that they use sketches and photos of their models to record their design journey during the making stage of the lesson.

6. Evaluate What You Have Made

Students will test and evaluate their designs against the design criteria they recorded before they started making their solutions. They can record notes on their Student Worksheets.

7. Present Your Model

Allow time for each student or student group to present what they have made to the class. A good way to do this is to set out a table large enough to display all of the models. If time is short, pair off the groups and have them present to each other.

8. Assessment

Students will use the Student Worksheet assessment rubric to evaluate their design work according to the 'Four Bricks Scale'.

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Take turns to share your ideas.

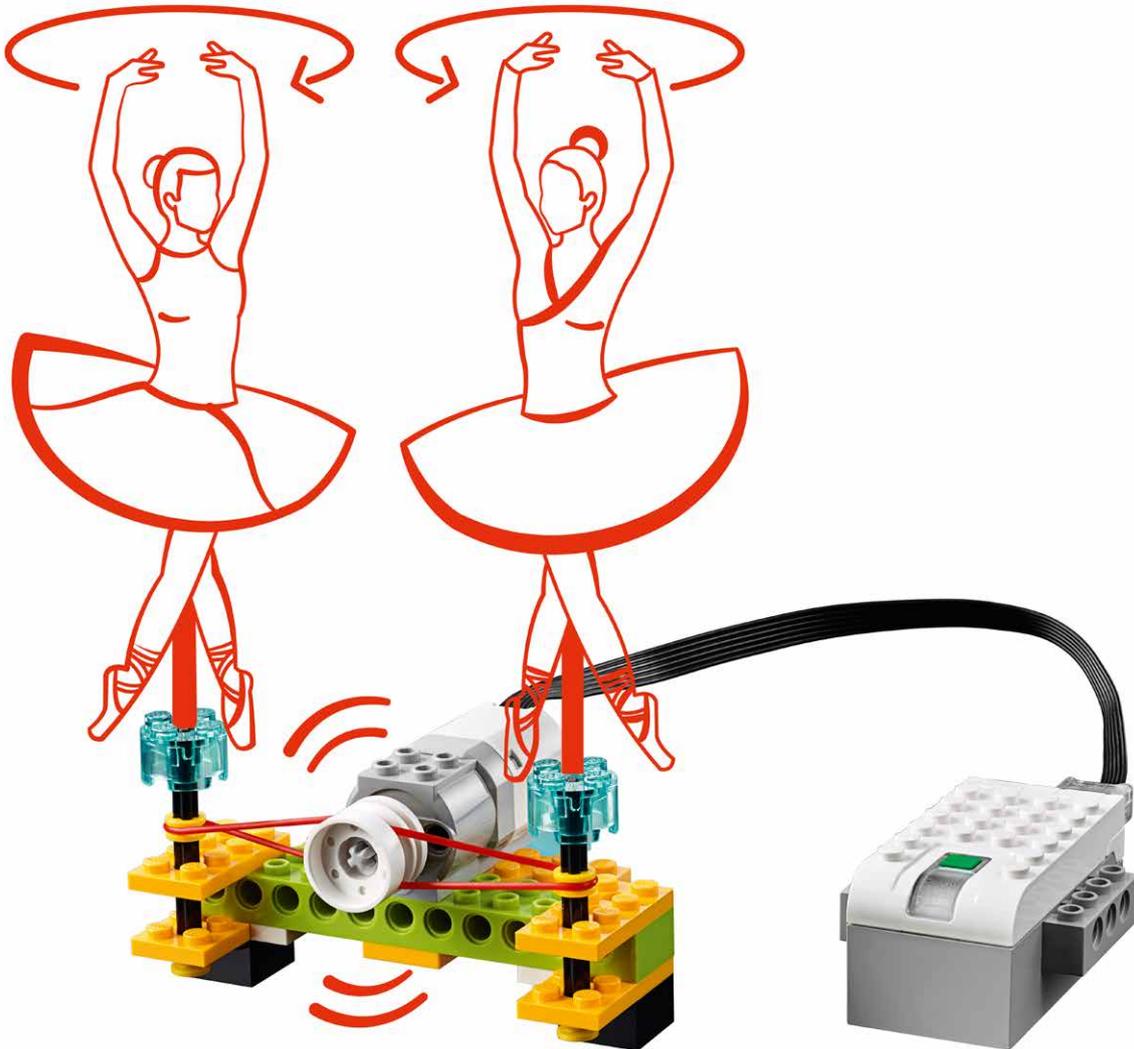


Tinkering Examples

Some students may need a little inspiration and scaffolding to help them get started.

Students can explore the Model Library to find inspiration for the different types of dances they can do. By asking questions (e.g., Do you want to make a dancing robot that spins? That walks?), you can help lead the students to relevant models based on their ideas. Students can remix their models by adding or removing LEGO® elements and “costume” pieces.

Sample model

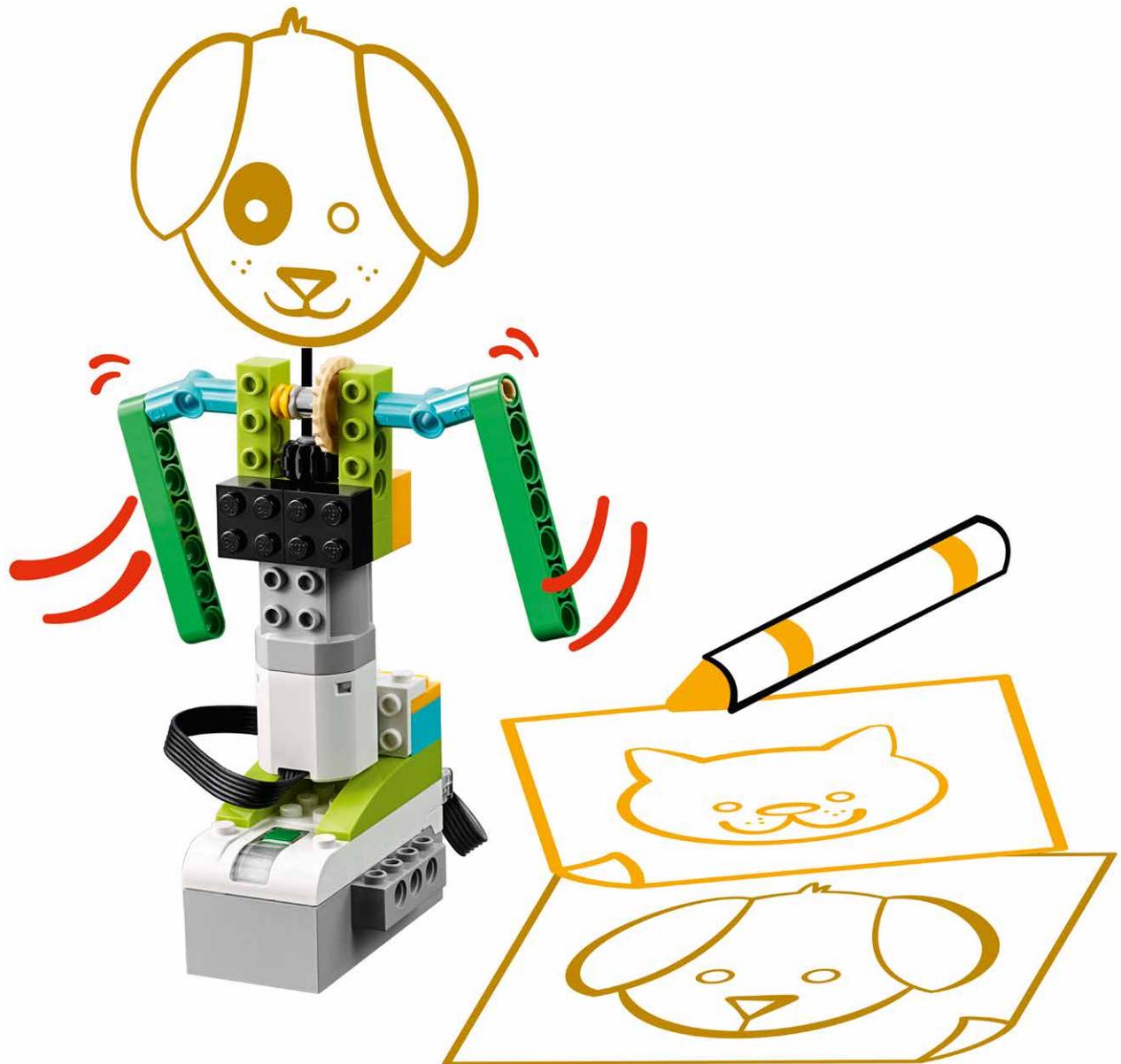


Remixed from #13. Sweep

Sample program



Sample model



Remixed from #1. Wobble

Sample program



Make a Dancing Robot

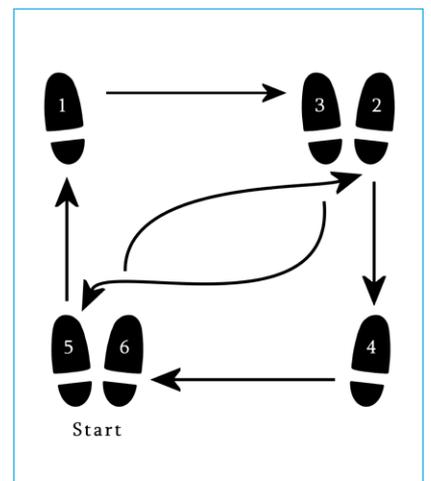
Maker Connect

Dancing is so much fun! Dancing can be moving freestyle to the rhythms of music or it can be more formal like ballroom dancing, tap dancing, square dancing, break dancing, ballet, and modern dance.

Dancing can express your personality and how you are feeling. Some types of dances are like codes and follow a set sequence of steps.

Look at the photos, then think about these questions.

- What questions do you have?
- What ideas do you have?
- What can you make?
- Can you make your own dancing robot?



Student Worksheet:

Make a Dancing Robot

Name(s): _____ Date: _____

Find a Problem

What ideas came to mind when you saw the pictures?

Brainstorm

Individual work: Now that you have found a problem, take three minutes to come up with ideas for solving it. Be prepared to share your ideas with your group.

Group work: Share and discuss your ideas for solving the problem.



Record as much as you can through sketches, photos and notes.



Use LEGO® bricks and sketches to explore your ideas.



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Go Make

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Evaluate What You Have Made

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Present Your Model

Now that you have finished, make a sketch or take a photo of your model, label the three most important parts, and explain how they work. You are now ready to present your model to the class.

Well done! What will you make next?



Three things your design must do.
Example:
The design must..
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You can use other materials from around the classroom.



Print your photos and attach all of your work to a legal size sheet of paper or card stock.



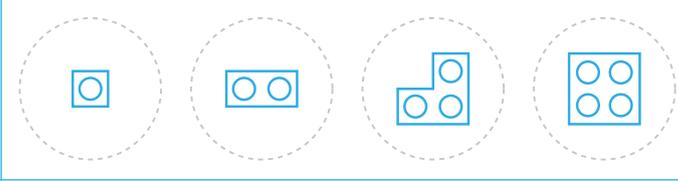
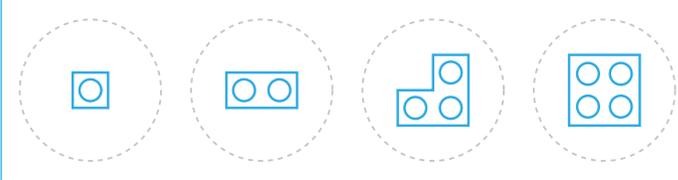
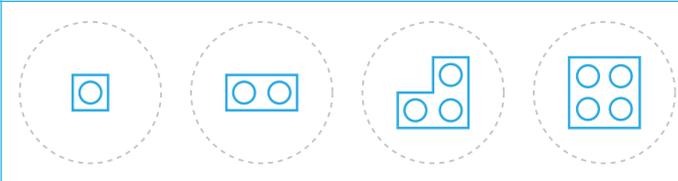
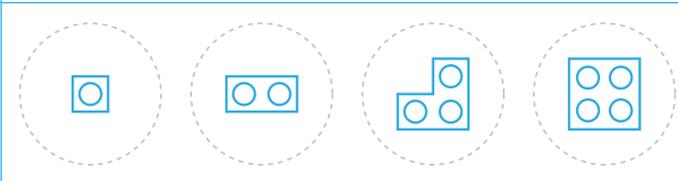
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<p>We joined ideas to build a good solution to a problem we found.</p>	
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<p>The final design was able to do everything it was supposed to do.</p>	

Describe what you did (draw, write or add a photo):

Tell someone about the problem you solved...

Make a Life Hack

There's inspiration for life hacks all around us. A great place to start is to have your students brainstorm simple problems they face in their daily lives. Ask them to think about things like:

- What could they make or hack together to make their lives easier?
- Do they need help waking up in the morning?
- Do they need a helper for household chores?
- Do they need a reminder to do something?

Be sure to have materials on hand that they can repurpose into something new.

Learning Goals

After completing this lesson, students will have:

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3. Brainstorm

Students should initially work independently or in pairs, spending a few minutes to generate as many ideas as they can to solve the problem. They can use the bricks from the LEGO® set during the brainstorming process, or sketch out their ideas in the space provided on the worksheet.



It is important for students to spend time tinkering with the LEGO® bricks in order to generate ideas. The goal of tinkering is to explore as many solutions as possible. You can use the tinkering examples at the end of these materials for inspiration, or as a means for getting started.

Students can now take turns sharing their ideas within their groups. Once all of the ideas have been shared, each group should select the best idea(s) to make. Be prepared to help facilitate this process, ensuring that the students choose an idea that is possible to make. Encourage diversity, not all groups have to make the same thing.

4. Choose the Best Idea

Students should record up to three design criteria on their worksheets. They will refer to this again as they review and revise their solutions.

5. Go Make

Let the students carry out one of their group's ideas using WeDo 2.0 and other materials as needed. Reinforce that students do not have to come up with the whole solution from the start.

During the making process, remind students to test and analyze their idea as they go, making improvements where necessary. If you want students to submit their documentation at the end of the lesson, ensure that they use sketches and photos of their models to record their design journey during the making stage of the lesson.

6. Evaluate What You Have Made

Students will test and evaluate their designs against the design criteria they recorded before they started making their solutions. They can record notes on their Student Worksheets.

7. Share Your Model

Allow time for each student or student group to present what they have made to the class. A good way to do this is to set out a table large enough to display all of the models. If time is short, pair off the groups and have them present to each other.

8. Assessment

Students will use the Student Worksheet assessment rubric to evaluate their design work according to the 'Four Bricks Scale'.

9. Tidy Up

Ensure that you leave approximately 10-15 minutes at the end of the lesson to break down the models and sort them back into the LEGO® boxes.

Take turns to share your ideas.

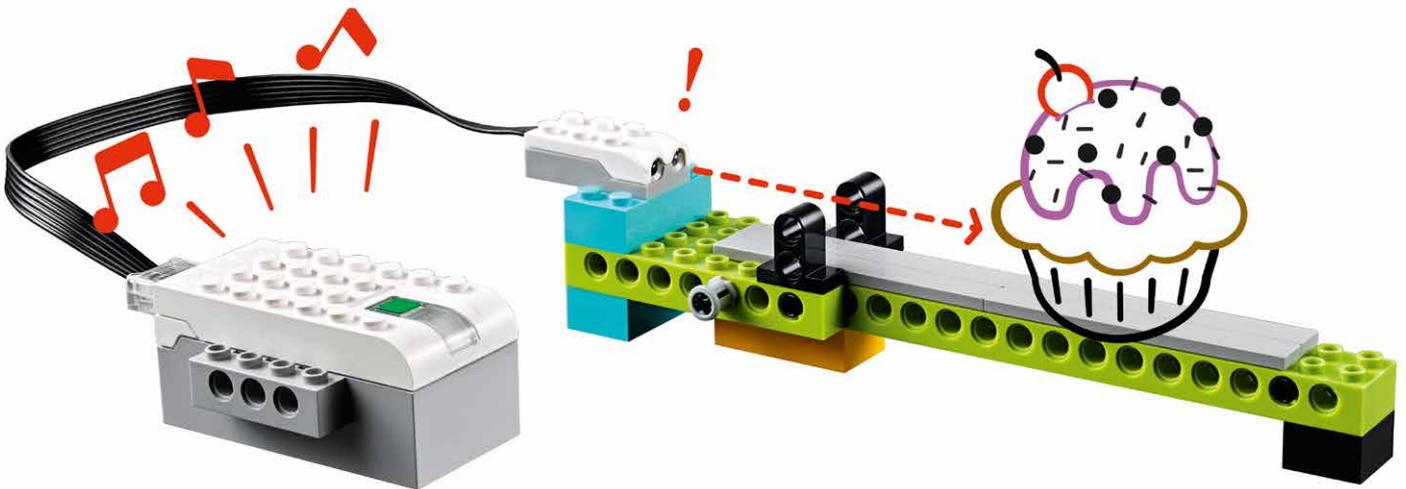


Tinkering Examples

Some students may need a little inspiration and scaffolding to help them get started.

Students can explore the Model Library to find inspiration for their solutions. By asking questions (e.g., Do you want to make a life hack that lifts something? That carries something? That protects something?), you can help lead the students to relevant models based on their ideas. Students can remix their models by adding or removing LEGO® elements and other objects.

Sample model

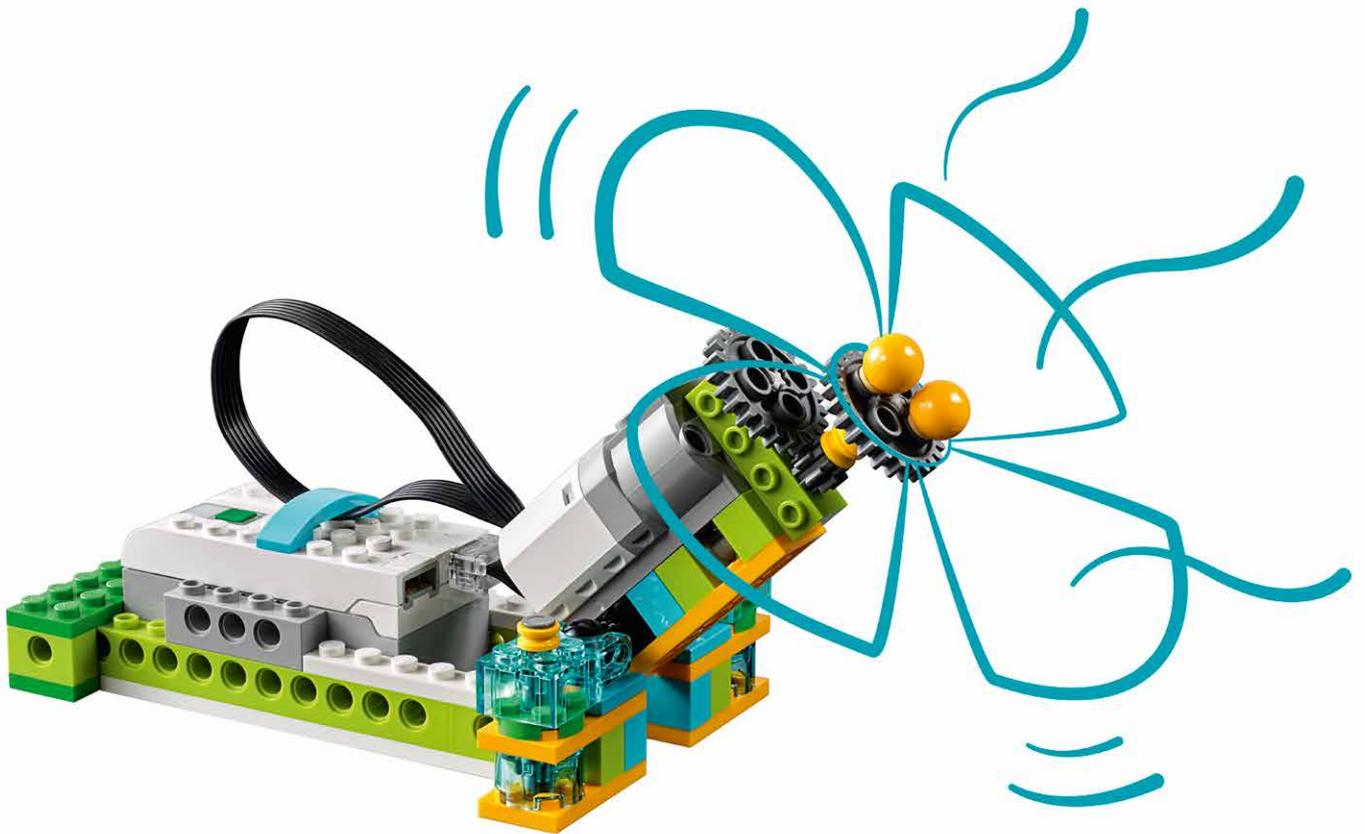


Remixed from #14. Motion

Sample program



Sample model



Remixed from #5. Spin

Fans can be dangerous, so choose your material and shape carefully.

Sample program



Make a Life Hack

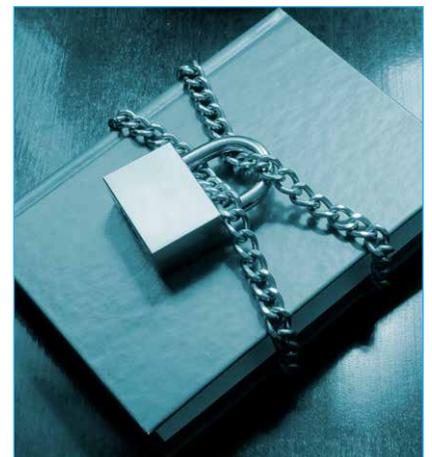
Maker Connect

Homework. Chores. Bedtime. Mealtime. What could make life less “ho-hum” and more fun!? Life hacks can!

Life Hacks are the original inventions! People have always been making things to improve how we live and do things. Life hacks are inventions you can make yourself by remixing everyday objects and materials in new ways. Some life hacks are old tricks or shortcuts. Some life hacks are tools to fix something, and some can help you be more organized in a fun way. In this lesson, you will create an invention to help solve one of the little problems in your life at home, school, or play!

Look at the photos, then think about these questions.

- What questions do you have?
- What ideas do you have?
- What can you make?
- Can you make your own life hack?



Student Worksheet:

Make a Life Hack

Name(s): _____ Date: _____

Find a Problem

What ideas came to mind when you saw the pictures?

Brainstorm

Individual work: Now that you have found a problem, take three minutes to come up with ideas for solving it. Be prepared to share your ideas with your group.

Group work: Share and discuss your ideas for solving the problem.



Record as much as you can through sketches, photos and notes.



Use LEGO® bricks and sketches to explore your ideas.



Sometimes simple ideas are the best ideas.



Choose the Best Idea

You should have come up with a number of ideas. Now choose the best one to make.

Write down three things your design must be able to do:

1. _____
2. _____
3. _____

Go Make

It is time to start making. Use parts from the LEGO® set to make your chosen idea. Test your design as you go and record any changes that you make.

Evaluate What You Have Made

Have you solved the problem that you found at the start of the lesson? Look back at the things you said your design must be able to do.

How well does your solution work? Suggest three things you could do better.

1. _____
2. _____
3. _____

Present Your Model

Now that you have finished, make a sketch or take a photo of your model, label the three most important parts, and explain how they work. You are now ready to present your model to the class.

Well done! What will you make next?



Three things your design must do.
Example:
The design must..
The design should..
The design could..



You can use other materials from around the classroom.



Print your photos and attach all of your work to a legal size sheet of paper or card stock.



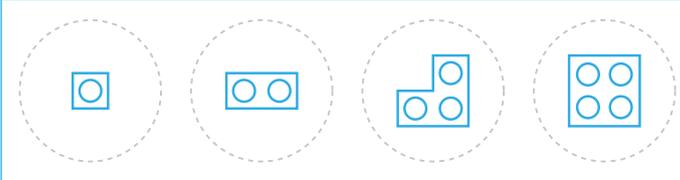
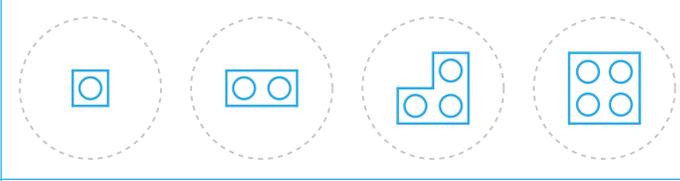
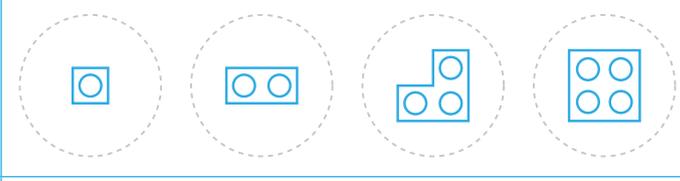
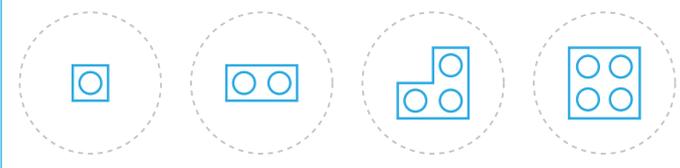
Self Assessment

Student Name: _____

Date: _____

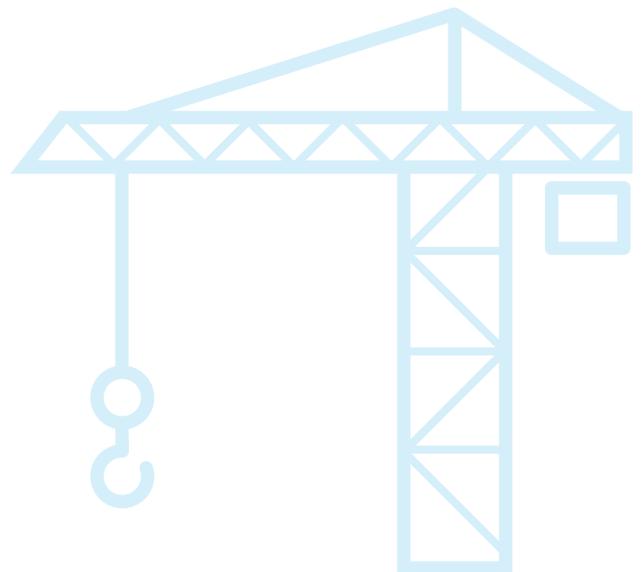
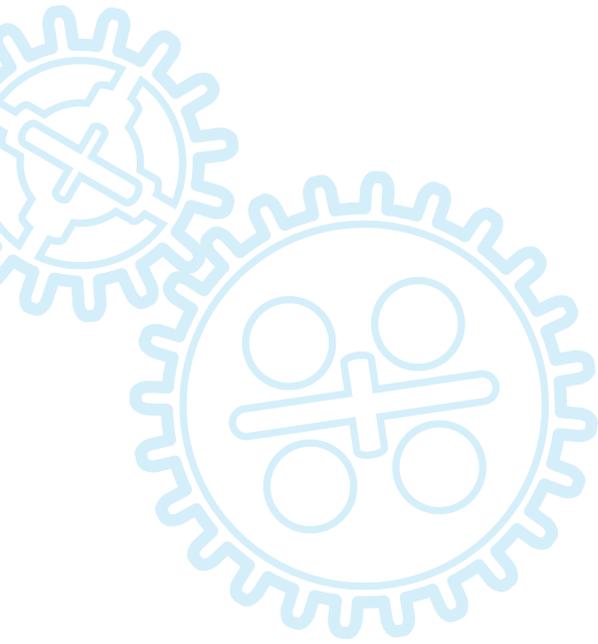
How did you do?

Directions: Circle the brick that shows how well you did. The bigger brick, the better you did.

<p>We built and tested one design or more based upon a problem we found.</p>	
<p>We joined ideas to build a good solution to a problem we found.</p>	
<p>We made our idea better based on our tests.</p>	
<p>The final design was able to do everything it was supposed to do.</p>	

Describe what you did (draw, write or add a photo):

Tell someone about the problem you solved...



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