

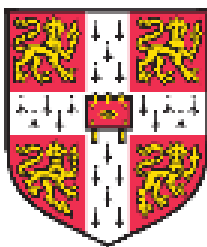
LEGO® Education Integrated STEM Education



Research Collaborations



Massachusetts Institute of Technology



University of Cambridge



Tsinghua University



Harvard University



Aarhus University



BRAC University

Through the Media Lab's Lifelong Kindergarten Group

Through the Research Centre on Play in Education, Development and Learning (PEDAL)

Lifelong Learning Lab

Through the Centre on the Developing Child and Project Zero

Centre for Child Research, Inst. for Education and Pedagogy, Mind Lab

Centre of Play at the Institute for Education Development

Legacy



The philosophy behind LEGO® MINDSTORMS® is to allow children not only to understand technology but also to become creative masters of it. This happens when they design, construct, and program their own intelligent inventions.



KJELD KIRK KRISTIANSEN
LEGO OWNER FAMILY



Children learn best when they are actively engaged in constructing something that has a personal meaning to them – be it a poem, a robot, a sandcastle, or a computer program.



SEYMOUR PAPERT
PROFESSOR OF LEARNING RESEARCH, MIT

Challenge with student confidence remains top of mind



3 out of 4

educators say anxiety and lack of confidence hinder learning among their students

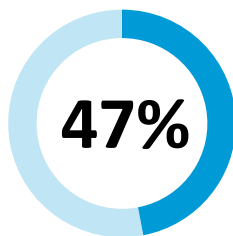


Only 1 in 3 educators

say their students are more confident in STEAM subjects compared to 5 years ago

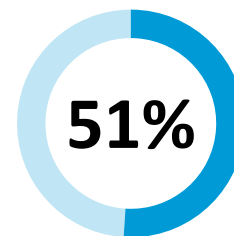


Fewer than 1 in 5 students are “very confident” when it comes to learning STEAM



47% of students

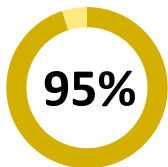
say that they avoid subjects where they’ve failed before



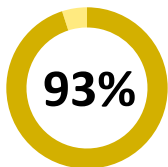
Half of students

today say trying new things at school makes them nervous

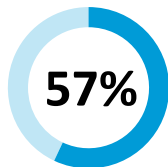
Building confidence with active, hands-on STEAM learning



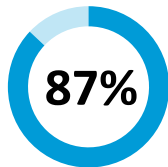
95% of educators believe the number 1 way their students can build confidence in STEAM subjects is working on hands-on projects with others



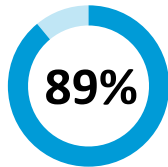
93% of parents believe the number 1 way their students can build confidence in STEAM subjects is working on hands-on projects with others



57% of students say they need "hands-on experience and tools" to master STEAM subjects



87% of students say they tend to remember the topics longer when learning through hands-on projects



89% of students say that hands-on learning helps them learn new things (and thus makes them more confident in learning new things)



Students who are confident in learning STEAM subjects are more than twice as likely to say they were confident in school today.

(82% confident in STEAM compared to 33% not confident in STEAM)

LEGO Education pedagogy



Learning through play

Joyful | Socially interactive | Actively engaging | Meaningful | Iterative | Our brain's favorite way to learn



Key educational methodologies

Constructivism | Constructionism



21st Century skills and the 5 Es

Creativity & innovation | Critical thinking | Communication | Collaboration | Engage | Explore | Explain | Elaborate | Evaluate

LEGO® Education SPIKE™ Prime

ACCELERATE STEAM LEARNING FOR
YOUR ENTIRE CLASS WITH A NEW,
INCLUSIVE, HANDS-ON SOLUTION



Solution Components



Unit plans



Bricks



Intelligent hardware



Coding

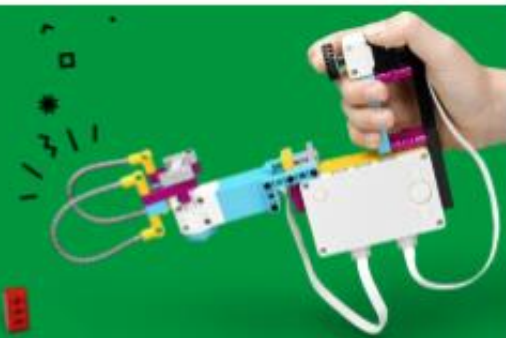
Professional development & teacher training

Develop Abstract Thinking in 6th - 8th Grades

STEAM

Invention Squad

Using the design engineering process



STEAM

Kickstart a Business

Applying and developing computational thinking skills



STEAM

Life Hacks

Working with data representation and manipulation



STEAM

Competition Ready

Getting ready for competitions and challenges





Lessons

Invention Squad (Lesson 1)



Help!

LEGO® Education SPIKE™ Prime Set

Define a problem by observing a scenario.

STEAM, Engineering

30-45 min. Beginner Grades 6-8

Invention Squad (Lesson 2)



Hopper Race

LEGO® Education SPIKE™ Prime Set

Design multiple prototypes to find the most effective way to move a robot without using wheels.

STEAM, Engineering

30-45 min. Beginner Grades 6-8

Invention Squad (Lesson 3)



Super Cleanup

LEGO® Education SPIKE™ Prime Set

Test the efficiency of two different grabber designs and determine the best design based on specific test criteria.

STEAM, Engineering

30-45 min. Beginner Grades 6-8

Invention Squad (Lesson 4)



Broken

LEGO® Education SPIKE™ Prime Set

Figure out why something isn't working and fix it

STEAM, Engineering

45-90 min. Beginner Grades 6-8

Invention Squad (Lesson 5)



Design for Someone

LEGO® Education SPIKE™ Prime Set

Use the complete design process to solve a real-world problem linked to prostheses.

STEAM, Engineering

120+ min. Intermed. Grades 6-8



Figure out why something isn't working and fix it



45-90 min.



Beginner



Grades 6-8

Lesson Plan

1. Prepare

- Read through the student material in the LEGO® Education SPIKE™ App.

2. Engage (5 Min.)

- Use the ideas in the *Ignite a Discussion* section below to engage your students in a discussion related to this lesson.
- Use the video to explain the lesson.

3. Explore (35 Min.)

- Have your students work in pairs to build the CNC machine, have them keep in mind that they're building a non-functioning machine.
- Ask them to run the program and to try to identify and correct the issues they see.
- Remind them to document the problems and their solutions.

4. Explain (10 Min.)

- Facilitate a sharing session. Encourage your students to talk about the problems they found and the solutions they came up with.

5. Elaborate (25 Min.)

- Ask each team to improve their CNC machine by modifying their build and/or program.
- Have them take turns sharing their improvements with the class.
- Don't forget to leave some time for cleanup.

6. Evaluate

- Give feedback on each student's performance.
- You can use the assessment rubrics provided to simplify the process.

Teacher Support

Key objectives



Things you will need



Additional resources



Educational standards



NGSS

MS-ETS1-3

Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

Common Core

CCSS.ELA-LITERACY.SL.6.2

Interpret information presented in diverse media and formats (e.g., visually, quantitatively, orally) and explain how it contributes to a topic, text, or issue under study.

CCSS.MATH.CONTENT.6.RP.A.1

Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities.

Differentiation

Simplify this lesson by:

- Suggesting a selection of bricks your students can use to fix the issues
- Asking all of the teams to work on the same upgrade so it's easier to assess the improvements

Take this lesson to the next level by:

- Having your students draw complex shapes on the printer, including curves
- Having your students transform this model into a 3D printer by adding a Z axis

Assessment Opportunities

Teacher Observation Checklist

Create a scale that matches your needs, for example:

1. Partially accomplished
2. Fully accomplished
3. Overachieved

Use the following success criteria to evaluate your students' progress:

- Students can describe the function of an object.
- Students can describe the benefit of an object's features against needs.
- Students can construct effective arguments.

Self-Assessment

Have each student choose the brick that they feel best represents their performance.

- Blue: I can describe how things work
- Yellow: I can describe in detail how things work and I can highlight what it's good at.
- Violet: I can convince someone that I've invented the coolest thing in the world.

Peer-Assessment

Encourage your students to provide feedback to others by:

- Having one student score the performance of another using the colored brick scale above.
- Asking them to present constructive feedback to each other so that they can improve their group's performance during the next lesson.

Language Arts Extension

To incorporate language arts skills development:

- Have your students work hands-off to role-play calling a customer support line.
 - ▷ One student describes the problem.
 - ▷ The other student explains how to fix it.

Note: This will make for a longer lesson.

Math Extension

To incorporate math skills development:

- Have your students find the gear ratio of the paper feed.
- Ask them to use appropriate language to describe how it controls the speed of the paper entering the CNC.
- Have them explain (and try!) what would happen if the gears were swapped.

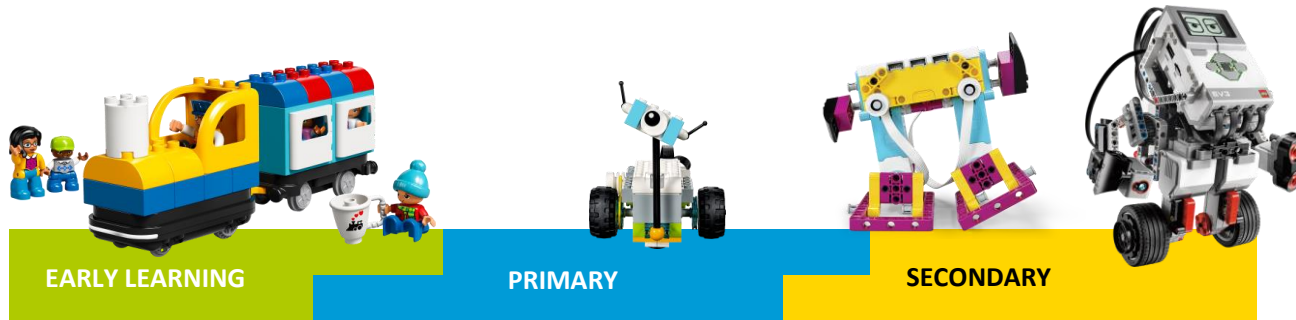
Note: This will make for a longer lesson.

Career Links

Students who enjoyed this lesson might be interested in exploring these careers pathways:

- Business And Finance (Entrepreneurship)
- Education And Training (Teaching)
- Media And Communication Arts (Broadcast Technology)

LEGO® Education - Learning Continuum



STEAM Park
Coding Express
and many more

WeDo 2.0
Early Simple Machines
Simple Machines

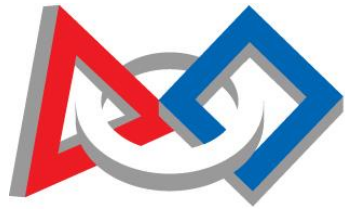
LEGO® Education SPIKE™
Prime
LEGO® MINDSTORMS®
Education EV3
Simple & Powered
Machines

Presents a clear
pathway to
building the right
skills for student
success

FIRST[®] LEGO[®] League competitions

Bring the fun to STEM learning, with hands-on, creative challenges that promote problem solving and team spirit





FIRST
LEGO
LEAGUE



Spasiba

谢谢大家

Merci Beaucoup

Gracias

Grazie

Danke Sehr

Tak

감사합니다

ありがとう

Bedankt

THANK
YOU