

Scribble bot

Students explore concepts of science, engineering and arts as they build a device that can scribble colorful patterns as it moves.

Materials

Necessary materials

Sign pen
AA battery
Battery Holder
Paper Cup
ON/OFF switch
Eraser
Naked Motor
Googly eyes
Scissors
Masking tape

Optional materials

Cardboard
Popsicle sticks
Construction paper
Plastic straw
Color pencils

Note: Underlined materials are to be shared among the students

Curiosity

Start with getting students to scribble on pieces of paper and make some colorless, random patterns.

Ask them if a machine can make such patterns. Get them to think about what such a machine would look like, and share their thoughts.

Activity

Sketching ideas

Ask students to think about what kind of device they can build in order to solve the problem. Ask them to get their pencils and notebooks to sketch their designs on.

Get groups to think-pair-share with their neighbors and explain their designs. They can also ask questions and provide feedback on each other's designs.

Scaffolding

Support students as they build their prototypes. Suggest ideas for starting, to groups who are struggling more than others. For example:

- Let's figure out how you can vibrate a motor

Ask questions about their design to groups who are about to waste a lot of time on obvious design flaws. The goal of these questions is to make students think about their designs and identify those errors.

- Can you tell me what role _____ plays in your device?
- How will _____ work in _____ condition?

You can also ask them to refer to the student guide for help.

Experimentation

You can provide structures for students to fill or ask questions to stimulate their thinking.

- I wonder what happens if _____
- What do you want to try next?
- What determines the path followed by your scribble bot? How can you change it?

Suggestions for the facilitator

We found these insights and tips to be helpful while facilitating this session.

- Short circuiting is a common problem; especially if students are new to electronics. Provide clear precautions at the start of class to get students careful.
- Students tend to leave the bot standing on paper with the sign pen legs uncapped. This causes the ink in the sign pen to be soaked into the paper, wasting ink, weakening the paper and poking a hole into it. This hole will later get other bots stuck while testing.
- Students need space and paper to test their bots. Have a few newsprint paper sheets laid out on the classroom floor for students to test their bots on. Make sure the floor under the newsprint paper is hard and smooth so that the sign pens at the legs of the bot don't poke holes on the paper and get the bot stuck.
- Scribble bots with heavy top and small base topple over easily. Making a larger base, or attaching the battery holder towards the middle or bottom makes scribble bots more stable.

Thinking

Reflection

Ask questions to help students reflect on their learning.

- What insights did you get in the process of making your thaumatrope?
- What challenges did you face while making? How did you overcome them?

You can also provide structures to support their thinking.

- Two things I learnt are _____
- I used to think _____ and I now think _____
- The most interesting part for me was _____ because _____

Ask students to work on a poster that summarizes their learning experience from this lesson. To make things interesting, ask them to sketch their ideas and ask them to think on reflective questions.

Think like a ...

Ask thought provoking questions to make students think from the perspective of a professional

Think like a scientist

- What makes your scribble bot move?
- What makes the motor rotate when you connect it to the battery?
- Name the circuit when the scribble bot is moving.

Think like an engineer

- What is the role of the eraser in creating movement?
- How can you change the path of movement of your scribble bot?

Think like an environmentalist

- How should we dispose of a dead battery?
- Which waste materials can you use to make scribble bot?

Sample lesson plans

1. A 60 minute class

Learning Objectives

To get students to experience the play based learning approach through building a machine that can scribble colorful patterns. The emphasis is on getting them to build and iterate on their design.

Classroom context

This sample lesson is designed for grade 6 students. Time available for the lesson is a 60 minutes class.

Lesson Flow

Curiosity (5/5 mins)

Ask students if they have seen art made of scribbled coloured lines. Ask them if it's possible for a machine to scribble such patterns. Inform them that in today's class they will be building such a machine and playing with it.

Activity (45/50 mins)

Building

Ask students to refer to the placemat. Provide them with the materials and give them 20 minutes to build their scribble bot.

Iteration

Once students are done building, ask them to test their work. Have a newsprint paper laid on the floor where students can test their scribbles.

Ask students to refer to the student guide and try making changes to their scribble bot. Give them 15 minutes for this.

Sharing

Ask students to pair with their neighbors and share the insights gained from their work on improving their scribble bot.

Thinking (10/60 mins)

Ask questions to help students reflect on their learning experience.

- Ask them to complete these sentences:
 - I used to think _____ and I now think _____
 - I now wonder _____
- What design of scribble bot worked well for you? What makes you say so?

2. Two 45 minutes classes**Learning Objectives**

To get students to experience the play based learning approach through building a machine that can scribble colorful patterns. The emphasis is on getting them to experiment and iterate on their design.

Classroom context

This sample lesson is designed for grade 8 students.

Lesson Flow**Class I****Curiosity (5/5 mins)**

Present students with the prompt given below:

“Miss Kalakaar is an artist and engineer who has been exploring ideas about building machines that can create art. One day she gets an idea about a machine that can make beautiful scribbles on paper.”

Ask - *do you have any idea what Miss Kalakaar’s machine might look like?* Encourage students to exchange ideas.

Inform them that in this lesson they will be building such a machine and playing with it.

Activity (30/35 mins)**Tinkering**

Provide students with the materials and ask them to make the motor rotate. Once they succeed, add the following tasks to the list:

- Make the motors rotate in opposite direction
- Make the motors vibrate

Provide them 10 minutes for this activity.

Building and Testing

Ask students to go through the student guide and build the scribble bot. Give them 20 minutes for this.

Once students have built their scribble bots, ask them to test them. Have a few newspaper papers laid on the classroom floor for this.

Thinking (10/45 mins)

Ask questions to help students reflect on their learning experience.

- What causes the scribble bots to move? What makes you say so?
- What was challenging about building the scribble?

Class II**Recalling (5/5 mins)**

Get students to sit in the same groups from the last class. Ask them to discuss among group members and recall their work from the previous class.

Activity (30/35 mins)**Experimentation**

Ask students to refer to the student guide and try to modify their scribble to accomplish the challenges given. Give them 20 minutes for this

Some students might need scaffolding during this stage. Ask leading questions to help them experiment.

- What would you like to try next?
- Which idea from the worksheet would you like to start with?

Sharing

Ask students to pair with their neighbors and exchange insights from their experiments. Ask a couple of students to volunteer at the end to share their key learnings with the whole class.

Thinking (10/45 mins)

Ask questions to help students reflect on their learning experience.

- What changes did you make to your scribble bot? What did you learn in doing so?
- What challenges did you face while building your scribble bot? How did you overcome them?