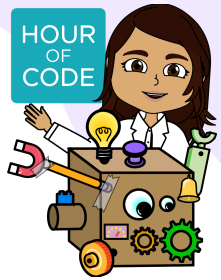
SCRATCH LESSON PLAN



Hour of Code™ 2024 with Scratch: Inventing with Gitanjali Rao

Scratch has teamed up with inspiring young scientist and innovator Gitanjali Rao (gitanjalirao.net) to celebrate Hour of Code™ 2024. We've created two activities to explore and remix, inspired by her innovations and advocacy. We also invite you and your learners to watch a replay of our live Create-Along with Gitanjali and Maren from the Scratch Team, which was live-streamed on our official YouTube channel (ScratchTeam) on December 10th.

In the first activity option, learners can design their own invention, share the invention's goal or purpose through text and/or a voice recording, and learn about Gitanjali's innovation process. In our second activity option, learners can develop and share a message of kindness, inspired by Gitanjali's innovative approach to anti-bullying efforts for young people around the world. For more on our kindness activity, click here.

Gitanjali is an author, speaker, and an active promoter of STEM education around the world. She was honored as Forbes "30 Under 30 in Science" in 2019, as well as *TIME*'s "Top Young Innovator" and "TIME Kid of the Year" for her innovations and the STEM workshops she conducts globally, which have inspired thousands of students across forty-six countries. At the Scratch Foundation, we design products and programs that support learners as they develop their thinking, their voice, and their identity. The Scratch Team is excited to create and explore with Gitanjali for Hour of Code™ because she inspires young innovators to try new ideas and develop meaningful solutions in community with others. Together, we can make the invisible visible by raising awareness about problems in need of solutions and bringing our ideas to life in prototypes, projects, and products to create amazing things that can change the world!

Resources for Learners:

- Hour of Code 2024 with Scratch: Invention Station Coding Cards (Student-Facing) - printable cards students can use to follow along with the lesson
- Hour of Code 2024 with Scratch: Invention Station Activity (Explainer Video) - a short video highlighting what the project entails and how to remix
- Poster: Gitanjali Rao Innovation Process 8.5x11 or 18x24 - a printable PDF
- Replay of our live Create-Along with Gitanjali and Maren from the Scratch Team

Additional resources provided throughout the guide.

Audience:

Classroom Teachers, Instructional Technology Specialists, Library Media Specialists, Informal Learning Environments

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Time: Activity Option: Invention Station - 60 minutes

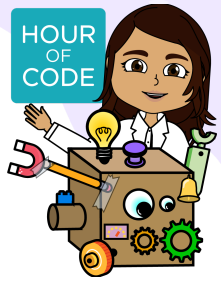
- Meet Gitanjali Rao
- Gitanjali's Innovation Process
- Observe, Brainstorm, Research…Imagine - 10 min
- Build - Create Your Invention in Scratch - 40 min
- Communicate - Share and Reflect - 10 min

We've provided timing for a 60 minute session, but you may opt to spread out over two separate sessions if learners need/want more time to tinker or you want to take more time to brainstorm, plan, and reflect.

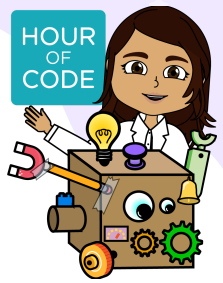
Objectives (Learners Will):

- Learn about Gitanjali's innovation process and brainstorm an invention they'd like to create
- Remix our starter project or create their own project to showcase their invention idea
- Communicate and share their projects with their learning community

See page 10 for aligned standards.



Activity Option: Invention Station



Meet Gitanjali Rao

Gitanjali Rao is a young inventor, scientist, author, speaker, and promoter of STEM education globally. She was honored as *TIME*'s "Top Young Innovator" and "TIME Kid of the Year" for her innovations and the STEM workshops she conducts globally. She was recognized as America's Top Young Scientist of 2017, and she was a recipient of an EPA Presidential award for her patented invention of an innovative lead contamination detection tool, just one of her many inventions. She is currently a sophomore at Massachusetts Institute of Technology.

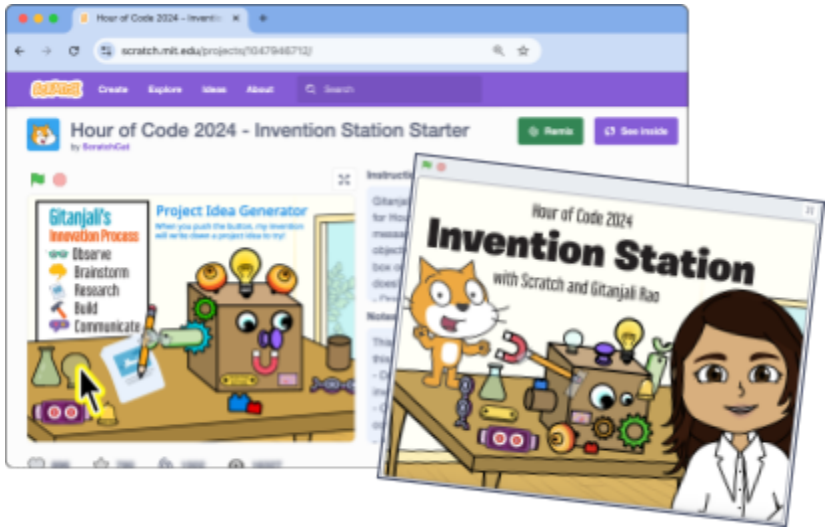
In this activity, learners will take the following steps (see additional sections below for more details):

Step 1: Meet Gitanjali by looking at ScratchCat's "Hour of Code 2024 - Invention Station Starter Project" (projects/1047946712) and hearing directly from her!

Step 2: Use a design journal to brainstorm a problem they want to solve, and then imagine the invention to solve it.

Step 3: Remix the Scratch project and create something awesome that helps change the world! As Gitanjali shares in the project, she likes to build/prototype as soon as possible and that is what we are doing here.

Step 4: Share and reflect and communicate about their invention to peers and fellow Scratchers.



The Project Page (above) and Project Editor view (below) of the Invention Station project.

Gitanjali's Innovation Process

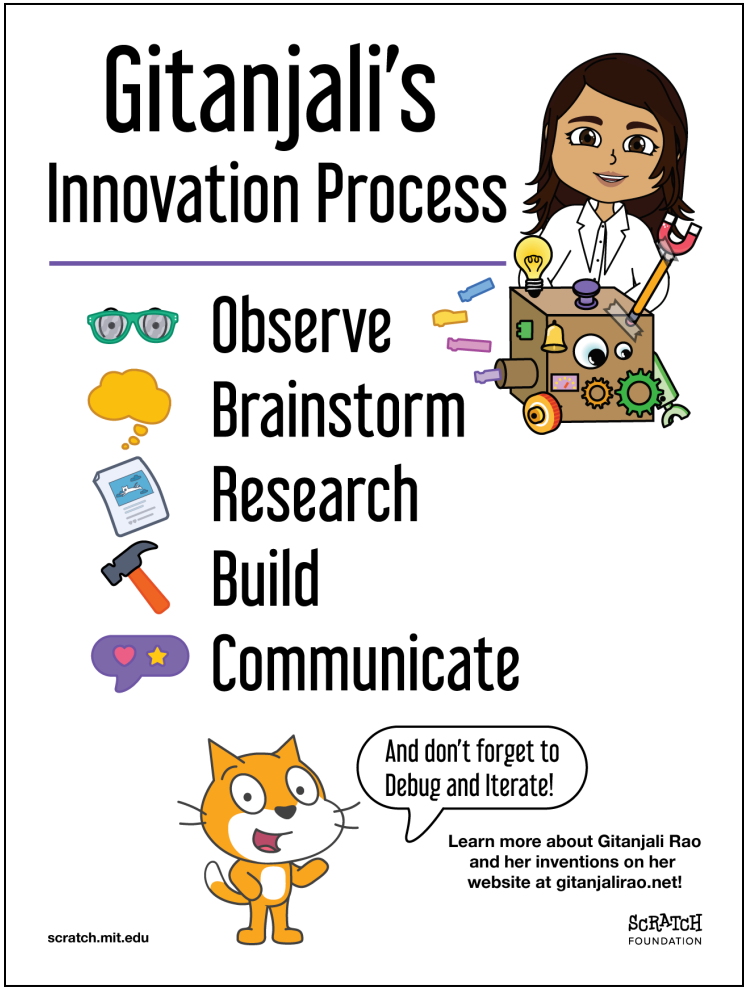
When thinking about a new invention, Gitanjali relies on the design thinking, creativity, and curiosity skills she developed as part of problem-based learning (PBL), which involves students learning by engaging with real-world problems.

Gitanjali's Innovation Process has five stages: Observe, Brainstorm, Research, Build, and Communicate. What is also key is that she isn't afraid of failure. Failing is just a first attempt, and then iterating is a natural part of the innovation process.

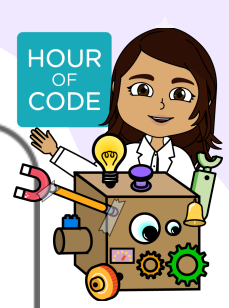
Her innovation process maps well onto Scratch's Creative Learning Spiral (Imagine, Create, Play, Share, Reflect, then Imagine Again!), as well as our strong belief in debugging, iterating on your work, and building community.

As described in the Forbes article "Design To Determination: Six Ways To Make Innovation A Repeatable Process," the following are the principles that ground Gitanjali's approaches:

- **Incorporate design thinking:** "All my solutions have had a human-based focus," Rao said. "It should always focus on how it impacts the user." Importantly, "empathy, kindness, and human focus are vital to successful innovation." Innovation is a two-way street, and works best through ongoing iteration from all sides. "Work through the nit-pick areas, work through those things that are constantly going to pull things back."



Get a copy of our printable poster by clicking here for 18x24 and clicking here for 8.5x11.



- **Embrace failure:** “Be a risk taker — failure is part of the process,” she advocates. “We need to normalize prototyping and brainstorming. Risks are important, regardless of the rewards.”
- **Act now:** “There’s no point in waiting to put an idea out there,” Rao said, noting that the more you bounce ideas off people, the better of a chance of success it has. “Communication is the most important area, because you get people’s feedback, and you grow more as an individual.”
- **Innovation cannot work on a deadline**: “Creativity can’t have a due date,” Rao stated. “You can’t give yourself a stop deadline. Keep everything in circulation, even if you are overwhelmed. You can push things to the side, but keep things in circulation.”
- **Persist and stay longer with the problem:** “Innovation is not a linear process. there’s no specific way you go about this process,” she pointed out. “You’re supposed to move around, and innovation isn’t prescriptive.”
- **Make it a team effort**: “When we hear about ideas from the past, everyone was really breaking things down into smaller components,” Rao said. “The smaller ones can be tackled individually. Yes, that works, it’s not efficient though. What we need to focus on is synthesis. Put teams together and then see if innovations work.”

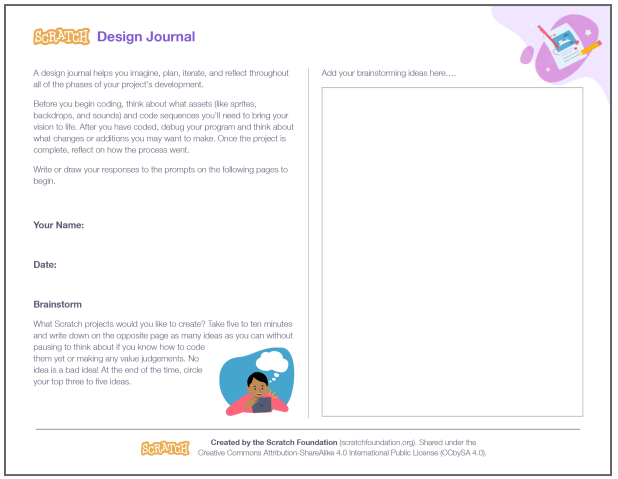
Using her Innovation Process, Gitanjali has created several inventions, including:

- Tethys, a patented **device to detect lead in drinking water** that is faster and more inexpensive than current techniques, based on the latest developments in carbon nanotube sensor technology
- Kindly, an **AI-based anti-cyberbullying service** that aims to detect and prevent cyberbullying at an early stage, which launched as an API available for use along with a variety of front-ends
- Epione, **device to diagnose prescription opioid addiction** using the latest developments in protein detection systems, based on the protein expression of the mu-opioid receptor gene.
- A **windshield barrier that absorbs laser light**, protecting pilots from laser beams directed at aircraft
- A **scanning app that detects the toxicity of snakebites**
- **Technology to better target drug delivery to lung tumors**

You can learn more about Tethys (Troubled By Flint Water Crisis, 11-Year-Old Girl Invents Lead-Detecting Device), Kindly, and Epione.

Observe, Brainstorm, Research…Imagine (10 minutes)

Before starting a new invention, Scratch project, or other creative endeavor, you may want to take time to brainstorm. You could use a design journal to record ideas and plans.


Scratch Design Journal

A design journal helps you imagine, plan, iterate, and reflect throughout all of the phases of your project's development.

Before you begin coding, think about what assets (like sprites, backdrops, and sounds) and code sequences you'll need to bring your vision to life. After you have coded, debug your program and think about what changes or additions you may want to make. Once the project is complete, reflect on how the process went.

Write or draw your responses to the prompts on the following pages to begin.

Your Name:

Date:

Brainstorm

What Scratch projects would you like to create? Take five to ten minutes and write down on the opposite page as many ideas as you can without pausing to think about if you know how to code them yet or making any value judgements. No idea is a bad idea! At the end of the time, circle your top three to five ideas.

Add your brainstorming ideas here....

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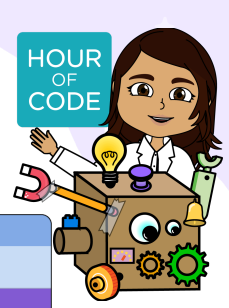
Take a portion of the learning time to encourage students to observe or think about real-world problems, these could be something to help out their family at home, something to help your community, or larger global issues. Brainstorm ideas to address those problems, and (if time allows) research factors like what solutions may already exist/or are being worked on, facts about the problem, materials, etc.

Resources:

- Scratch Design Journal (Worksheet) - imagine, plan, and reflect throughout all of the phases of project development
- UN Global Goals Initiative (Website) - an example of information sources on critical, real-world issues representing common interests and challenges faced across the world

Build - Create Your Invention in Scratch (40 minutes)

Let's create something awesome that helps change the world! As Gitanjali shares in the project, "When I'm inventing, I like to build my idea as soon as possible, so that I'm able to visualize it and I have more motivation to keep going." We'll build/prototype our invention following her process, and design a solution to a problem that you identify. (Or learners can create their own project about the innovation processes or their invention idea.)



Step 1: Meet Gitanjali by looking at [ScratchCat's "Hour of Code 2024 - Invention Station Starter Project"](projects/1047946712) (projects/1047946712) and hearing directly from her!

Click, drag, or hover over the objects. Some sprites will respond to your mouse or when touching the box or are close to the box. Experiment to see what each does!

Step 2: Remix the project. (Note: For offline Scratch users, download the starter project and upload it into the downloaded version of Scratch to experiment with it.)

Step 3: Drag each sprite to the box and create your own invention.

(Note: By default, sprites can only be dragged/moved around with the mouse when working in the Project Editor, but *not* when viewed on the Project Page. So how did we make objects draggable when on the Project Page? See inside to view the code and see how we set the drag mode or see our coding cards below.)

Step 4: Customize sprites in the costume editor and/or add your own (see the "Add Your Object Here" sprite).

Step 5: Add code to animate. Explore adding code blocks to rotate sprites, change their size, change their color/brightness/other effect, switch costume, play a sound, etc. The possibilities are endless!

Encourage curious Scratch users to look inside the project to see some code already in place. Notice some

The Project Page of the Invention Station project.

The Project Editor view of the Invention Station project.

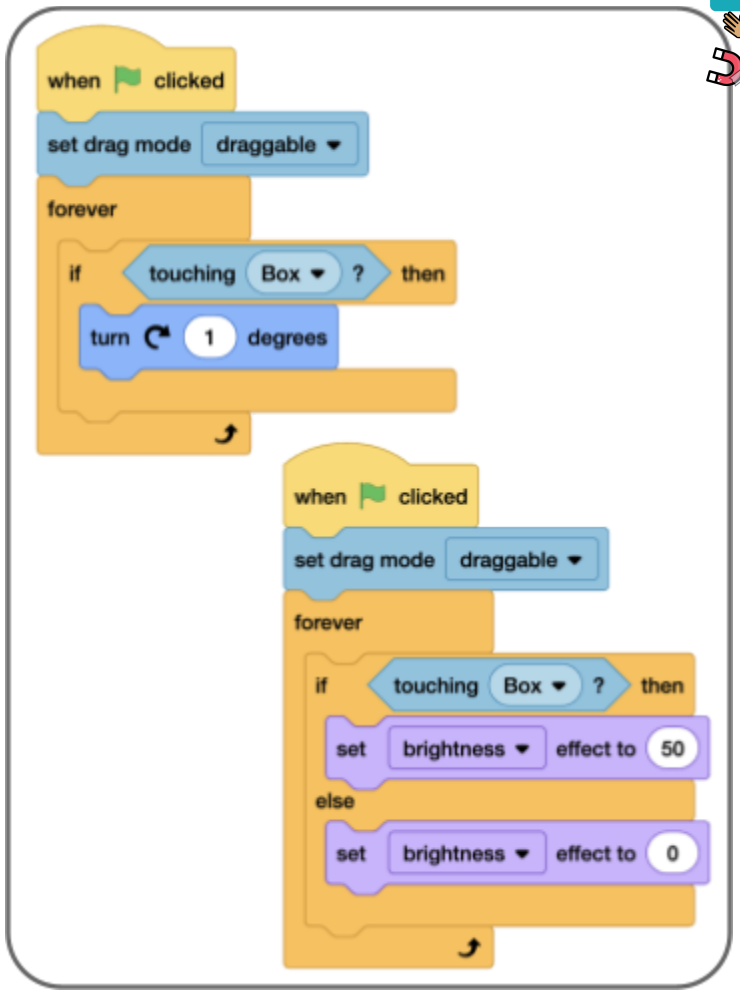
sprites are coded using the “touching box” sensing block inside an “if then” or “if then else” conditional statement. When adding code, you may want to try similar sequences. (Note: conditional statements are a more advanced coding topic. See our resources below for more guidance.)

Step 6: Don’t forget to share details about your invention! Record a message to play about what your invention does, and give it a name and description (see the “My Invention Button” and “My Invention Title” sprites).

Step 7: On the Project Page, make sure your project also has clear Instructions on how a user can interact with it and/or Notes with more information on what inspired your idea or what your invention is about.

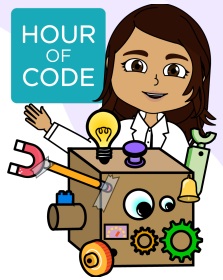
Resources:

- Hour of Code 2024 with Scratch: Invention Station Coding Cards (Student-Facing Cards) - printable cards students can use to follow along with the lesson
- Hour of Code 2024 with Scratch: Invention Station Activity (Explainer Video) - a short video highlighting what the project entails and how to remix
- Conditional Statements: Make Interactive Projects (Part 1) | Tutorial (Video)
- Conditional Statements: Nesting, Debugging, and Beyond (Part 2) | Tutorial (Video)
- Conditional Statements (Written Guide)
- Conditional Statements Coding Cards (Coding Cards)



Example code stacks to animate a sprite when it is touching the invention box.

See our student-facing, printable coding cards and watch a replay of our live Create-Along with Gitanjali and Maren from the Scratch Team to remix and experiment along with us!



Communicate - Share and Reflect (10 minutes)

Ready to spread the word about your new invention? Share your remix in our studio, which will go live for Hour of Code™ week, starting on December 9th. Look for the studio in the Featured Studios row on the homepage that week, or linked in the project description. Or create your own class studio or a gallery walk where learners can share their projects. (See more information below.)

Resources:

- Show-and-Tell Sharing Sheet (Worksheet)
- Project Gallery Walk Self-Reflection and Peer Feedback Sheet (Worksheet)

Share Option #1: Create a Class Studio to Gather Shared Projects

Studios are a space on Scratch where users can come together to make, share, and collect projects related to a particular theme, idea, or prompt. Set up a class studio* for your learners and add their original asset projects. Learners are encouraged to take time to look at projects and read/listen/interact with them.

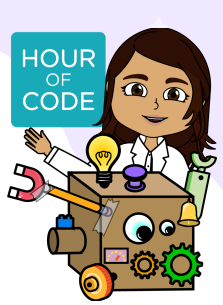
Resources:

- Teacher Account Guide (Written Guide) - This resource contains information on setting up teacher accounts and student accounts, managing classes, and class studios.
- Scratch Studios Guide (Written Guide) - Information on setting up and managing studios generally.

**Note: Learners will need a Scratch account and access to the online Scratch editor to participate in this option.*

Share Option #2: Gallery Walk

Have each participant's project open on their computer or other device. Participants can walk around a room, or take turns sharing their screen in a virtual space, to experience each other's creations. Another option is to display one project at a time on a large screen. Learners are encouraged to take time to look at projects and read/listen/interact with them.



More Things to Try

- Debugging Reflection (Worksheet) - Dive into the practice of debugging with learners and use this reflection sheet to help them explore.
- Debugging Strategies Posters (Printable Posters)

Looking to learn more? The Scratch Foundation has partnered with The Achievery to provide free beginner and intermediate creative coding lesson plans on a variety of topics for educators, caregivers, and learners. **Sign up (for free!) for the Achievery by using our custom partner code "SCRATCH"** when you register to support our work! https://www.theachievery.com/account/signup

Standards Aligned

CSTA Standards	ISTE Standards	CASEL Framework	RITEC Indicators
Link to full standards	Link to full standards	Link to full standards	Link to full standards
• 1B-AP-10 Create programs • 1B-AP-12 Modify, remix, or incorporate • 1B-AP-14 Give appropriate attribution • 1B-AP-15 Test and debug	• 1.1a Learning Goals • 1.1d Technology Fundamentals • 1.5.c Decompose Problems • 1.5.d Algorithmic Thinking • 1.6.b Creative Communicator • 1.6.c Communicate Complex Ideas • 1.7.a Global Connections	• Self-awareness • Self-management	• Autonomy • Competence • Creativity

This lesson also fulfills all three of the ISB Indicators of Playful Learning (Choice, Delight, Wonder), developed by the Pedagogy of Play (PoP) research project at Harvard University.

The 'Hour of Code™'/'Hora del Código®' is a global initiative by Computer Science Education Week and Code.org to introduce millions of students to one hour of computer science and computer programming.

Tip: If you'd like to translate this guide, **click here to make a copy** of this Google doc.