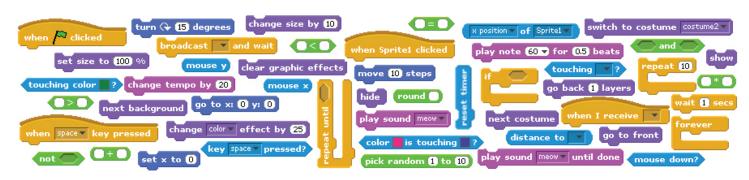
RESOURCES

Ideas, approaches, and activities for cultivating computational thinking and computational creativity in your classroom



Resources from a summer workshop for middle-school and high-school teachers Organized by the MIT Media Lab, in collaboration with Google's CS4HS initiative

Overview

In this workshop for middle-school and high-school teachers, we explored new educational technologies and instructional strategies to engage students in creative design activities -- and, in the process, help students develop as computational thinkers and computational creators.

The workshop was designed around four core ideas about learning experiences (designing, personalizing, collaborating, reflecting), with the intention of providing teachers the same opportunities for learning that we imagine for their students. Teachers designed, created, experimented, and explored with computational media (more specifically, with Scratch), and we also spent time discussing how these types of ideas and activities can be introduced to and shared with students.

This page provides a sketch of the workshop and some of the resources that we created for it. If you have any questions, we encourage you to join ScratchEd and post your questions and comments in the CS4HS discussion forum.

Sessions

In the workshop, participants use Scratch to create many different genres of projects: art, stories, sensing, and games. As part of these projects, participants explore important computational concepts and practices that are at the core of Computational Thinking. Participants learn about **concepts** like sequences and loops, parallelism and events, conditionals and operators, variables and lists. These are core concepts in computer science, but they are also helpful concepts for creating all types of projects, in all types of disciplines.

While working on projects, participants also learn about important computational **practices** - that is, strategies and approaches for working on computational projects. Participants learn how to create things in an incremental, iterative style; how to test ideas and programs to make sure they work and how to debug them when they don't; how to reuse media and programs from other people and remix them to create something new and different; how to bundle ideas and programs into black-box abstractions, and how to divide problems and projects into modular parts.

Session #1: Introduction to Creative Computing

The main objectives of this first session are to: (1) give a sense of what's to come in the workshop, and (2) build excitement and anticipation. This involves providing some background information about Scratch, computational thinking, and design-based learning, sharing inspiring examples of what is possible to create with Scratch, and creating a space to experiment with Scratch in a hands-on way.

Activities/Resources

Introductory presentation
URL: http://scratched.media.mit.edu/resources/intro-presentation-cs4hs-workshop
Audience: Educators
Approximate length: 15-30 minutes
Materials needed: Computer, projector, presentation software

Slides, speaker notes, and audio recording of Mitch Resnick's introductory presentation at the 2010 Creative Computing/CS4HS workshop hosted at the MIT Media Lab.

· Big ideas handout

URL: http://scratched.media.mit.edu/resources/computational-thinking Audience: Educators Approximate length: n/a Materials needed: Handouts

Two-page handout that summarizes our framing of computational thinking concepts and computational thinking practices, as well as designbased approaches to learning.

• Surprise me (a.k.a. Monkey Business)

URL: http://scratched.media.mit.edu/resources/monkey-business Audience: Educators, Students Approximate length: 30 minutes Materials needed: Computers, projector, Scratch, handouts

Handout for the "Surprise me"/"Monkey business" activity. This is an activity with very little scaffolding. After demonstrating the basic mechanism of snapping blocks together, participants are asked to make a project in which something surprising happens either to themselves or to a monkey. The handout provides some additional scaffolding by recommending particular blocks to experiment with. After participants have had about 10 minutes to work on their projects, participants are gathered to share different things they learned or noticed about Scratch as they created their projects.

Account creation

URLs: http://scratched.media.mit.edu/, http://scratch.mit.edu/ Audience: Educators Approximate length: n/a Materials needed: Computers, projector, Scratch, network connection

Links to the ScratchEd and Scratch websites. Participants can create accounts on the two sites to share and find Scratch projects, and to share and find Scratch educator resources.

Session #2: Art

The main objectives of this second session are to: (1) develop greater fluency with Scratch through hands-on experiences in the art genre, (2) explore the computational concepts of sequences and loops.

Activities/Resources

Marching orders
URL: http://csunplugged.org/sites/default/files/activity_pdfs_full/unplugged-12-programming_languages.pdf
Audience: Educators, Students
Approximate length: 30 minutes
Materials needed: Paper, pencils, images to recreate

Handout describing the "Marching orders" activity, created by Computer Science Unplugged. Computers are powerful, but they don't do things on their own. They require instructions to be able to do things, and the act of specifying instructions is programming. In this activity, participants experience what it's like to "be programmed", given instructions for how to draw a picture.

• Orange square, purple circle URL: http://scratched.media.mit.edu/resources/square-circle Audience: Educators, Students Approximate length: 45 minutes Materials needed: Computers, projector, Scratch, handouts

Handout describing the "Orange square, purple circle" activity, with recommended blocks, and a set of sample projects. Participants create projects that include an orange square and a purple circle, playing with visual constraints.

Interactive collage URL: http://scratched.media.mit.edu/resources/interactive-collage Audience: Educators, Students

Approximate length: 60 minutes *Materials needed:* Computers, projector, Scratch, handouts

Handout describing the "Interactive collage" activity. Participants create an interactive project about a topic of interest that responds in different ways to mouse clicks.

Session #3: Stories

The main objectives of this third session are to: (1) develop greater fluency with Scratch through hands-on experiences in the story genre, (2) explore the computational concepts of parallelism and events.

Activities/Resources

Doing two things at once
URL: http://scratched.media.mit.edu/resources/blocks
Audience: Educators, Students
Approximate length: 30 minutes
Materials needed: Paper Scratch blocks

PDFs and JPGs of Scratch blocks for the "Doing two things at once" activity. Participants use the paper blocks to program solutions to several challenges that explore the concepts of parallelism (making things happen at the same time) and events (one thing causing another thing to happen) proposed by the facilitator, including having:

- one person doing one task (like walking), then introducing the notion of resetting
- · one person doing two tasks (like walking and talking)
- a second person simultaneously doing a task (like talking)
- the second person doing a dependent task (like talking after the first person)

• Pass-it-on story

URL: http://scratched.media.mit.edu/stories/csed-week-day-4-wise-dance-party Audience: Educators, Students Approximate length: 60 minutes Materials needed: Computers, projector, Scratch

Video documenting the "Pass-it-on story" activity, as done with a group of teenage girls. Participants collaboratively construct a story by each starting a story and then rotating to another computer, continuing the story found there. After two rotations, participants return to their computers to see how the story has evolved.

Story time

URL: http://scratched.media.mit.edu/resources/story-time Audience: Educators, Students Approximate length: 90 minutes Materials needed: Computers, projector, Scratch, handouts

Collection of one-page handouts with different story-themed starter projects:

- a slideshow of pictures and audio narration
- a conversation between two characters
- a dynamically created story
- a multi-scene story

Session #4: Sensing

The main objectives of this fourth session are to: (1) develop greater fluency with Scratch through hands-on experiences in the sensing genre, (2) explore the computational concepts of conditionals and operators.

Activities/Resources

• Debug it

URL: http://scratched.media.mit.edu/resources/debug-it Audience: Educators, Students Approximate length: 30 minutes

Materials needed: Handouts

Collection of five small Scratch programs that aren't working the way the creator intended. Participants work in small groups to debug the programs, and then share their solution approaches.

• WeDo

URL: http://scratched.media.mit.edu/resources/wedo-project-ideas Audience: Educators, Students Approximate length: 90 minutes Materials needed: Computers, projector, Scratch, WeDo robotics kits, handouts

Collection of one-page handouts with different WeDo-themed starter projects:

- · using the distance sensor and set size block to make the cat smaller and larger
- using the distance sensor, set color effect block, and the play note block to make the character change color and play music
- $\circ~$ using the tilt sensor and change x/y blocks to make the cat move around the stage
- · using the tilt sensor and next costume block to scroll through a sprite's costumes
- using the motor blocks, key pressed blocks, and move block to control the motor and move the cat by pressing the left and right arrows

Session #5: Games

The main objectives of this fifth session are to: (1) develop greater fluency with Scratch through hands-on experiences in the games genre, (2) explore the computational concepts of variables and lists.

Activities/Resources

Adding variables to a game URL: http://scratched.media.mit.edu/stories/meaningful-and-motivating-use-variables-game-project Audience: Educators Approximate length: 5 minutes Materials needed: Computer, projector, Scratch

Speaker notes, and video recording of Mitch Resnick introducing variables in a game context.

· Let's play

URL: http://scratched.media.mit.edu/resources/lets-play Audience: Educators, Students Approximate length: 120 minutes Materials needed: Computers, projector, Scratch, handouts

Collection of one-page handouts with different game-themed starter projects:

- · getting through a maze
- helping a cat navigate a minefield
- spelling a collection of words

Session #6: Conclusion

The main objectives of this sixth and final session are to: (1) develop greater fluency with Scratch through the design of an independent project, (2) explore ways in which Scratch is being used in the classroom.

Activities/Resources

Show and tell
URL: http://scratched.media.mit.edu/resources/scratch-educator-show-tell-videos
Audience: Educators
Approximate length: 45 minutes
Materials needed: Computer, projector, Scratch, network connection

Videos of educators describing how they have been using Scratch in the classroom after participating in the Creative Computing/CS4HS workshop.

Using these resources

These resources (except CS Unplugged's Marching Orders) were created by Karen Brennan and Mitch Resnick. This work is licensed under a Creative Commons Attribution 3.0 Unported License -- and we encourage you to use, remix, and share everything you find here!

