



# Project-based Learning with Scratch

Jared O'Leary  
BootUp PD



# What's the plan?

- Project-based learning?
- Explore Scratch projects
- Q&A

# How to reach the resources

- [www.JaredOLEary.com](http://www.JaredOLEary.com)
  - Presentations
  - Project-based Learning with Scratch






# Project-based learning?

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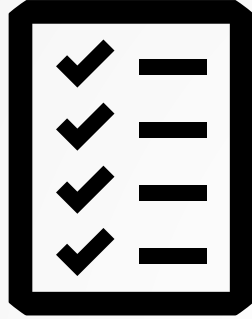
- “Project-based learning is built on the idea that real-life problems capture student interest and provoke critical thinking and develop skills as they engage in and complete complex tasks that typically result in a realistic product, event, or presentation to an audience.” (p. 40)

Tobias, E. S., Campbell, M. R., & Greco, P. (2015). [Bringing Curriculum to Life: Enacting Project-Based Learning in Music Programs](#). *Music Educators Journal*, 102(2), 39–47

1. Central to the curriculum
2. Organized around driving questions
3. Focused on a constructive investigation
4. Student-driven
5. Authentic

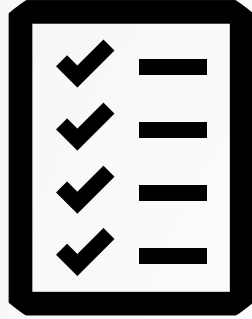


Tobias, E. S., Campbell, M. R., & Greco, P. (2015). [Bringing Curriculum to Life: Enacting Project-Based Learning in Music Programs](#). *Music Educators Journal*, 102(2), 39–47



Fixed





Fixed



Open







# Example: Fixed project criteria

- ▶ Game
- ▶ One player sprite
- ▶ Three enemy sprites
- ▶ At least two “if \_ then” blocks
- ▶ At least one variable



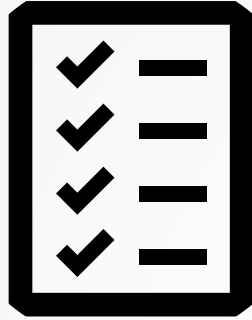
# Example: Open project questions

- ▶ Can you create a school appropriate project that...
  - ▶ ...helps someone?
  - ▶ ... is scary, funny, exciting, boring, musical, silly, relaxing, or colorful?
  - ▶ ... solves a problem you see in the world?
  - ▶ ... reminds you of a special event, story, or place?
  - ▶ ... you can give as a gift to someone else?
  - ▶ ... you can use for another class?

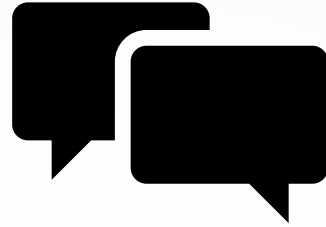


# Example: Open project questions

- ▶ Can you create a **school appropriate** project that...
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  - ▶ ... you can give as a gift to someone else?
  - ▶ ... you can use for another class?



Fixed



Flexible



Open





## **Example:** Flexible prompts with embedded criteria

- ▶ What type of project can you create that includes at least two “if \_ then” blocks and at least one variable?
- ▶ How might you create a game that keeps track of a score?
- ▶ Storyboard and create a superhero(ine) project that uses several different “Events” blocks.



# Example: Storyboard questions

- ▶ What sprite(s) will you use as superhero(ines)?
  - ▶ What kind of superpowers or technology will they have?
  - ▶ Will they transform into their superhero(ine) costume or always be a superhero(ine)?
    - ▶ If they are transforming, what will they look like normally? What will they look like when they are a superhero(ine)?
- ▶ Who will the superhero(ines) try and save?
  - ▶ What kind of danger are they in?
  - ▶ If it's another sprite, what kind of powers or technology will they use?
- ▶ How might your superhero(ine) save the day?
  - ▶ What algorithms can you create to do that?
- ▶ Will users be able to interact with your superhero(ine) project?
  - ▶ If so, what kind of code will you use to create that interaction?

# Example: Storyboard questions

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  - What kind of superpowers or technology will they have?
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  - What algorithms can you create to do that?
- Will users be able to interact with your superhero(ine) project?
  - If so, what kind of code will you use to create that interaction?

1. Choose a worthy topic
2. Find a real-life context
3. Create generative questions
4. Develop critical thinking and cultivate dispositions
5. Decide the scope
6. Design the experience



Tobias, E. S., Campbell, M. R., & Greco, P. (2015). [Bringing Curriculum to Life: Enacting Project-Based Learning in Music Programs](#). *Music Educators Journal*, 102(2), 39–47

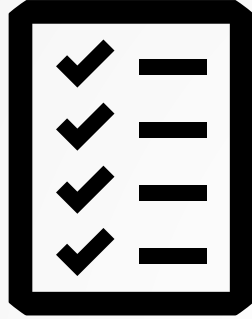
U N D E R S T A N D I N G

by D E S I G N

# Backward design projects

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GRANT WIGGINS AND JAY MCTIGHE



Fixed



Flexible

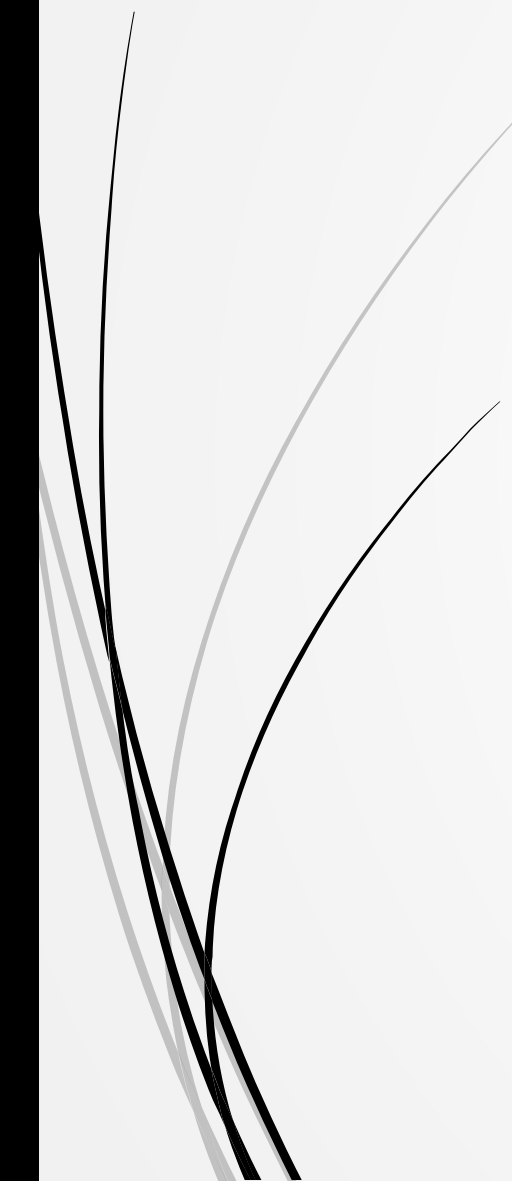


Open





# Backward design

1. Identify the desired results
    - a. Big ideas
    - b. Enduring understandings
    - c. Essential questions
  2. Determine evidence
  3. Plan learning experiences
- 

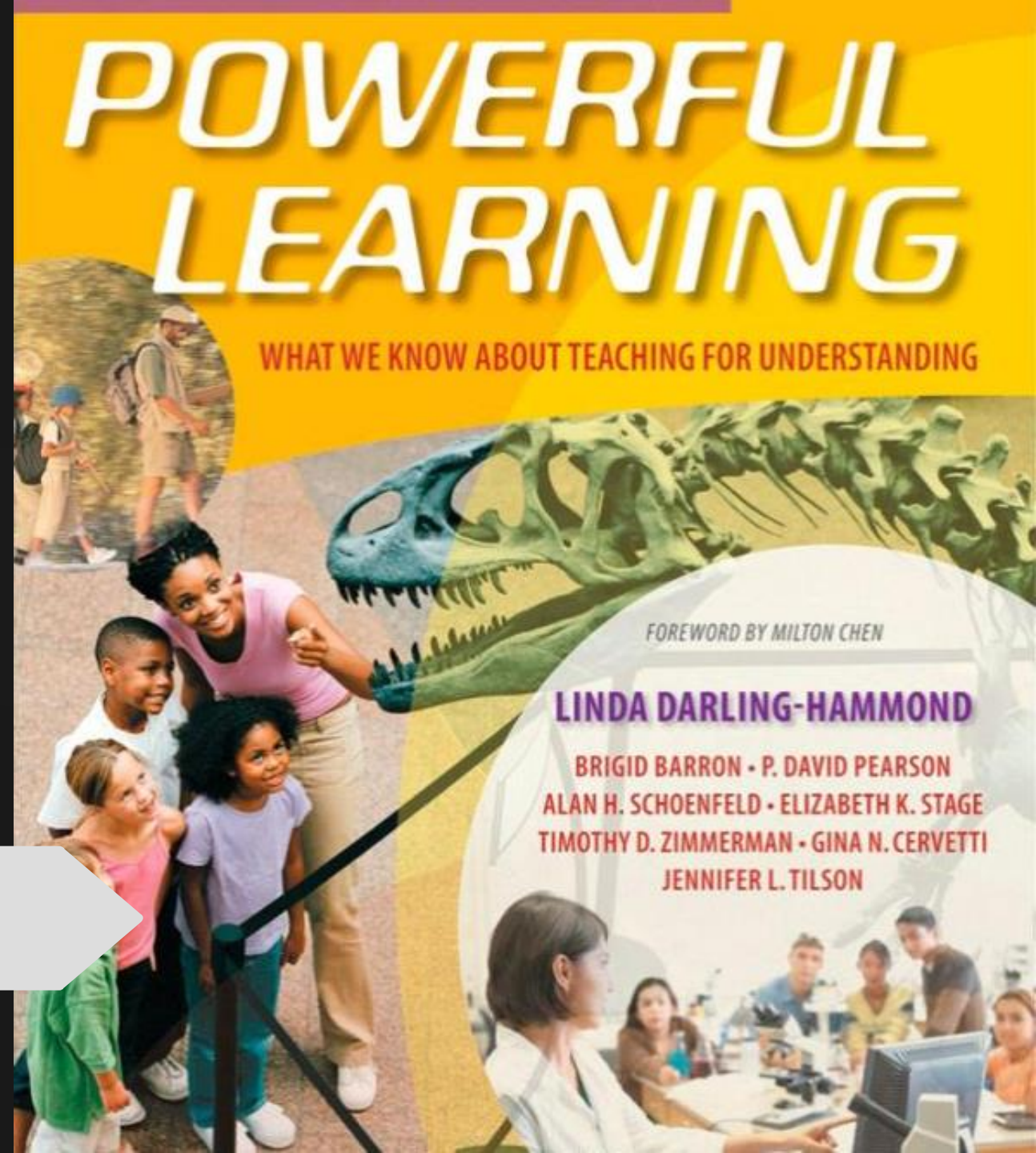
networks for various contexts.

forming choices for media artworks? How can presenting or sharing media artworks in a public format help a media artist learn and grow?

3 <sup>rd</sup> (MA:Pr6.1.3)	4 <sup>th</sup> (MA:Pr6.1.4)	5 <sup>th</sup> (MA:Pr6.1.5)	6 <sup>th</sup> (MA:Pr6.1.6)	7 <sup>th</sup> (MA:Pr6.1.7)	8 <sup>th</sup> (MA:Pr6.1.8)	HS Proficient (MA:Pr6.1.I)
a. Identify and describe the presentation conditions, and take on roles and processes in presenting or distributing media artworks.	a. Explain the presentation conditions, and fulfill a role and processes in presenting or distributing media artworks.	a. Compare qualities and purposes of presentation formats, and fulfill a role and associated processes in presentation and/or distribution of media artworks.	a. Analyze various presentation formats and fulfill various tasks and defined processes in the presentation and/or distribution of media artworks.	a. Evaluate various presentation formats in order to fulfill various tasks and defined processes in the presentation and/or distribution of media artworks.	a. Design the presentation and distribution of media artworks through multiple formats and/or contexts.	a. Design the presentation and distribution of collections of media artworks, considering combinations of artworks, formats, and audiences.
b. Explain results of and improvements for presenting media artworks.	b. Explain results of and improvements for presenting media artworks.	b. Compare results of and improvements for presenting media artworks.	b. Analyze results of and improvements for presenting media artworks.	b. Evaluate the results of and improvements for presenting media artworks, considering impacts on personal growth.	b. Evaluate the results of and implement improvements for presenting media artworks, considering impacts on personal growth and external effects.	b. Evaluate and implement improvements in presenting media artworks, considering personal and local impacts, such as the benefits for self and others.

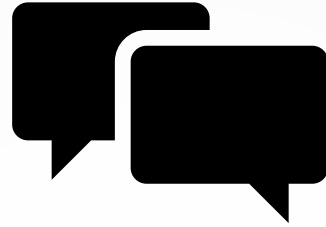
# National Core Arts Standards

# Inquiry-based projects





Fixed



Flexible



Open





A decorative graphic on the left side of the slide. It features a grey arrow pointing right at the top, and several curved lines in black and grey that sweep upwards and to the right, framing the text.

# Inquiry-based project stages

1. Vision
2. Inquiry
3. Build
4. Showtime
5. Transition

THIRD EDITION

# Young Investigators

THE PROJECT APPROACH  
IN THE EARLY YEARS

Emergent projects



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Judy Harris Helm & Lillian G. Katz



Fixed



Flexible



Open





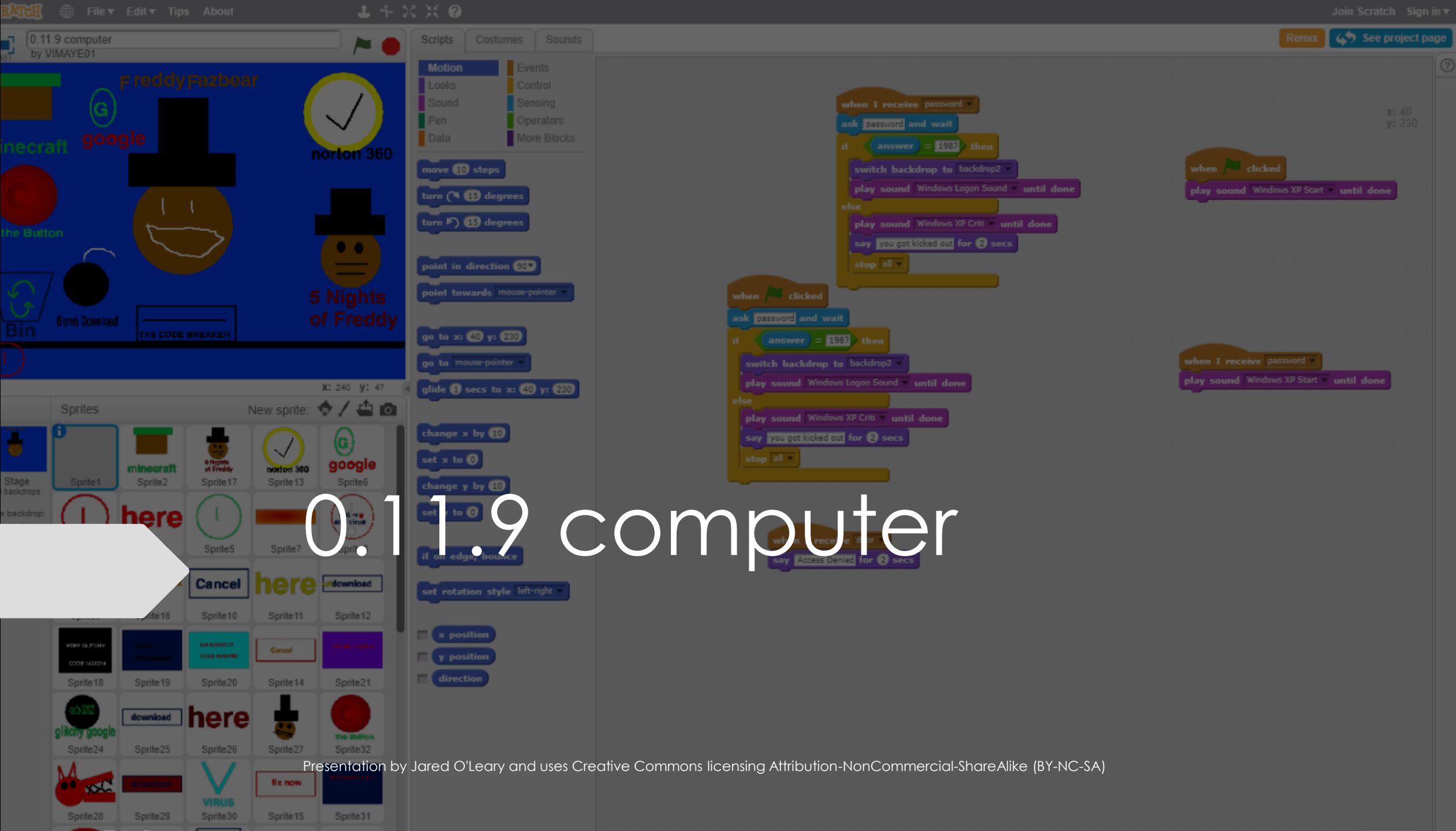
# The project approach phases

1. Determine a topic
2. Plan and investigate the topic
3. Culminating event/activities and assessment

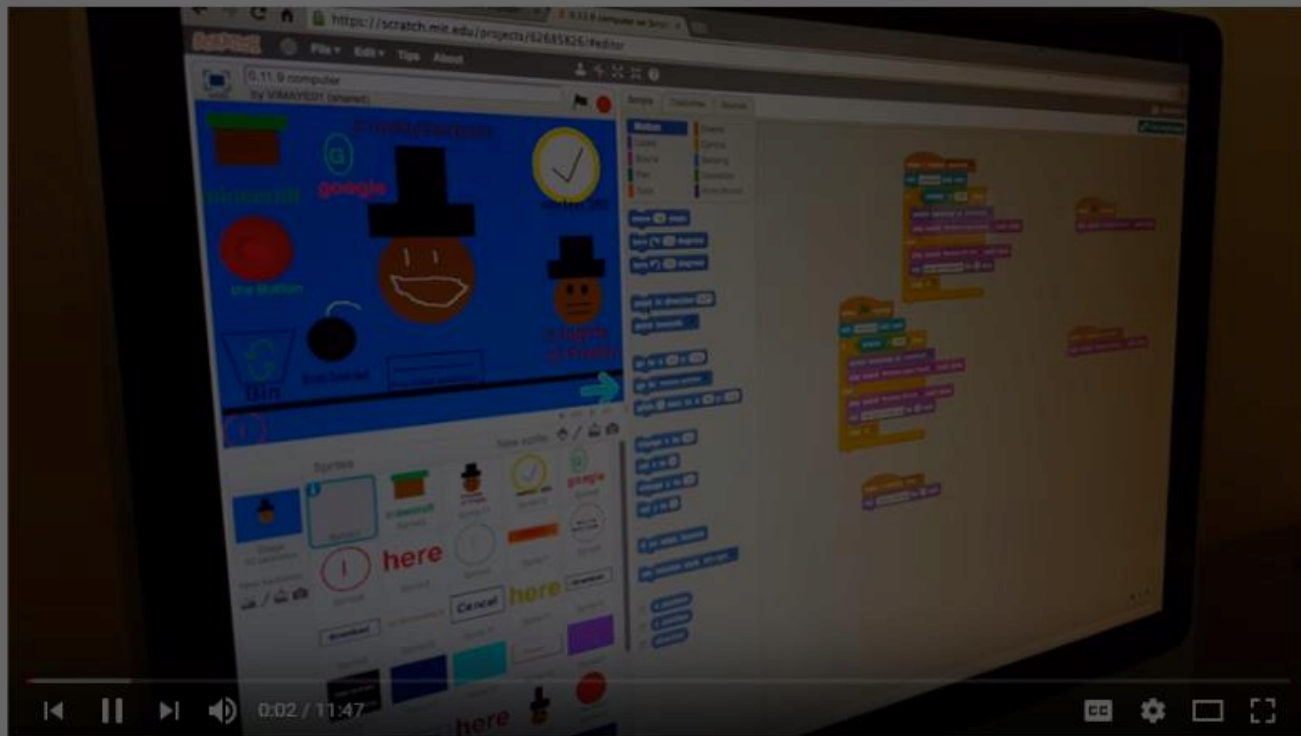


# If using a sequential curriculum . . .

- Create a base project idea or theme
- Layer in new concepts and understandings
- Revisit throughout the year



# 0.11.9 computer



- K-8 Computer Programming
- Jared O'Leary · 8 / 43
- DT Technology - 4/29/16 - 4th grader sharing two projects  
Jared O'Leary  
11:48
  - DT Technology - 4/29/16 - 6th Grade - Full class overview of Sonic Pi,  
Jared O'Leary  
2:03
  - DT Technology - 12/3/15 - 8th Grade - Learning Fur Ellise  
Jared O'Leary  
1:34
  - DT Technology - 10/29/15 - 4th Grade - Sound design with Scratch  
Jared O'Leary  
0:42
  - DT Technology - 9/11/15 - 6th Grade - Demonstration of facilitating an  
Jared O'Leary  
37:30
  - DT Technology - 5/18/15 - Week 2 - 7th Grade - MaKey MaKey music  
Jared O'Leary  
0:56

# Video walkthrough

DT Technology - 4/29/16 - 4th grader sharing two projects

Views



Jared O'Leary  
Uploaded on Apr 30, 2016

ANALYTICS EDIT VIDEO

A video of a 4th grader sharing two projects he's been working on this year. Visit my website for free resources for Scratch (the program he's using) and other computer programming platforms: [www.JaredOLeary.com](http://www.JaredOLeary.com)

SHOW MORE

0 Comments SORT BY

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- The transformative power of classical music | Benjamin...  
TED  
Recommended for you  
20:44
- Learning from dirty jobs | Mike Rowe  
TED  
Recommended for you  
20:03
- The Discipline of Finishing: Conor Neill at...  
TEDx Talks  
Recommended for you
- Time bending -- 365 ways to unlock creativity and innovatio...  
TEDx Talks

# 2nd-8th grade project examples

**Desert Thunder**

Updated 23 Feb 2016

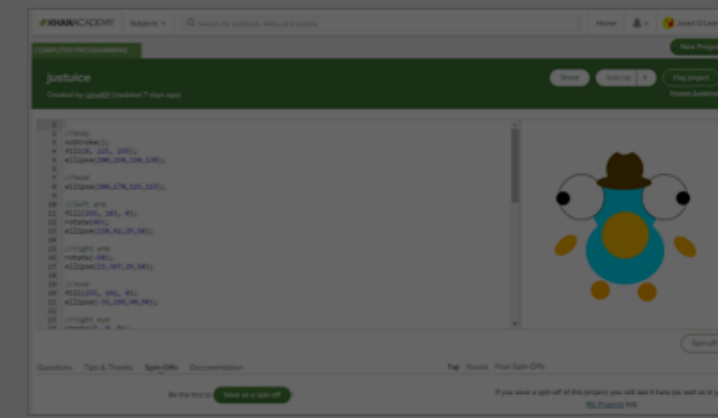
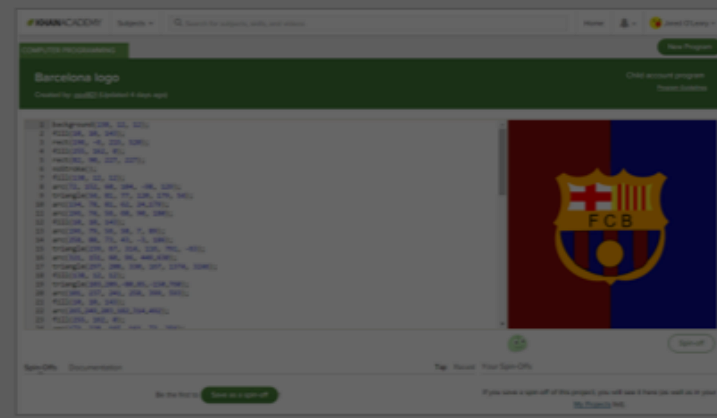
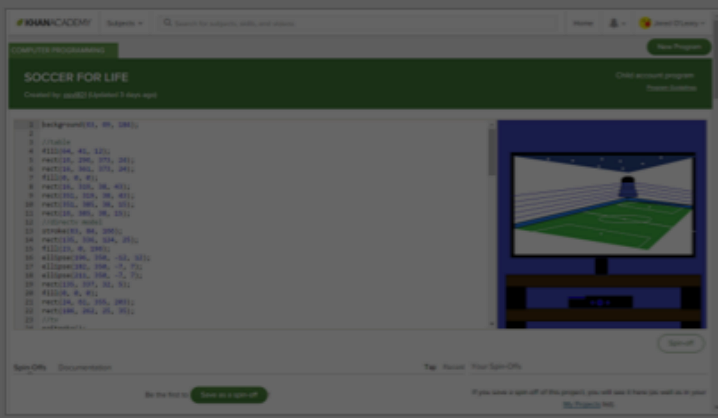
Some sample projects from peers at DT.

**Desert Thunder** ( 6 Followers )

Projects ( 100+ )   Comments ( 2 )   Curators   Activity

A black screen with the text "TO BE CONTINUED..." in a white, stylized font.	A black screen with the text "GAME OVER ROBERT FELL" in a white, stylized font.	A dark screen with a yellow and black striped pattern on the left side.	A colorful, abstract pattern of many small, multi-colored shapes.
Random Story- Randall... by pmiss01	The Epic (Never-ending... by taevan01	??? by ivcast01	Trippy butterflys by tatafo01
A white screen with the text "Fall Army" and a red heart.	A colorful, abstract pattern of many small, multi-colored shapes.	A scene from the movie Beauty and the Beast showing Gaston.	A white screen with the text "THE END" in a black, stylized font.
Fall Army by resapp01	Trippy Stoolf by JUNGUY01	Beauty And The Beast by pahenn01	SUMMER TIME by SASEEL01
A scene from a Pokemon game showing a battle.	A green screen with a cactus and a water bottle.	A white screen with the text "Thanks for watching" in a black, stylized font.	A white screen with a black speech bubble containing a candy.
Pokemon battle water L... by owar01	Stay Hydrated! by ahlamp01	pistol by DAROBE01	guess the candy by ancar02
A photo of a fluffy, light-colored dog.	A red screen with a guitar and a microphone.	A scene from a Disney movie showing a character.	A scene from a game showing a character in a dark environment.
Guess That Breed!!!!!! by brdele01	Music for you by shpale01	disney by argonz01	Hardest Game of 2018: ... by cafost01
A blue screen with the text "WELCOME TO THE EPIC NEVER-ENDING GAME" and "START!".		A scene from a game showing a room.	A scene from a game showing a volcano.
WELCOME TO THE EPIC NEVER-ENDING GAME START! by taevan01	by khaas01	NO MORE MONKEY JUMPING ON THE BED by adkeec01	THE VOLCANO by pmiss01

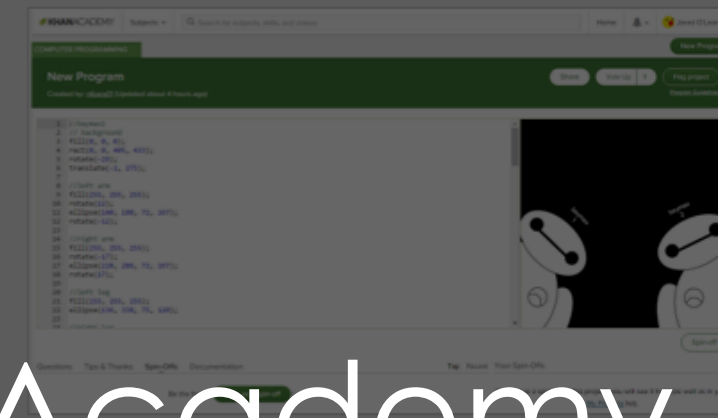
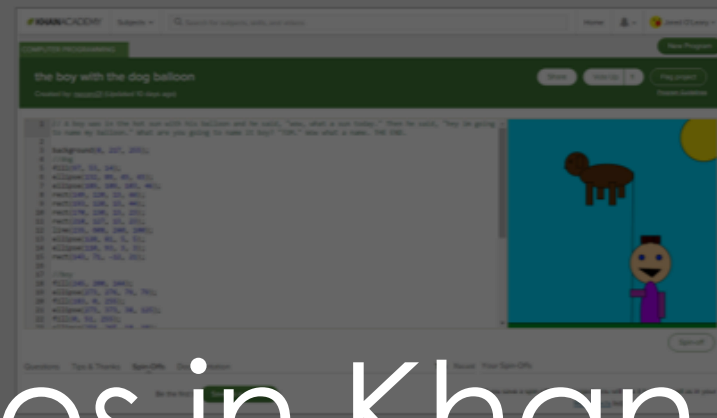
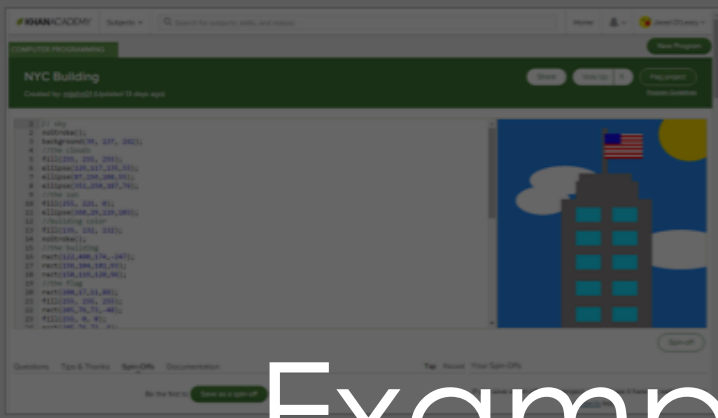
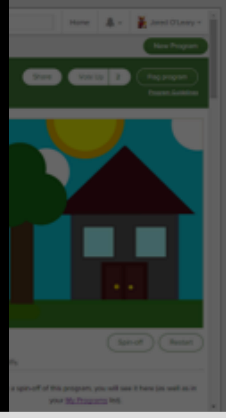




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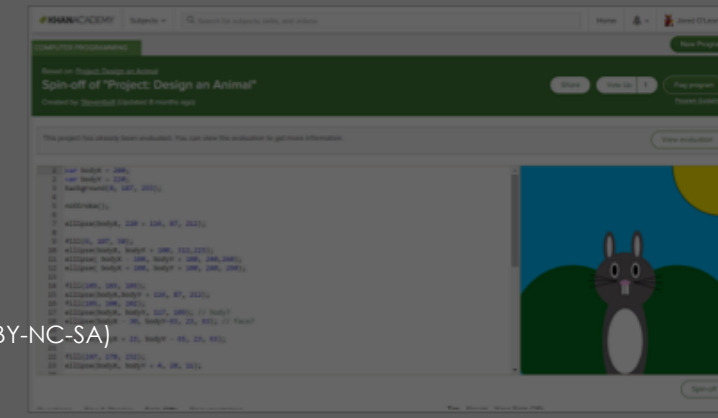
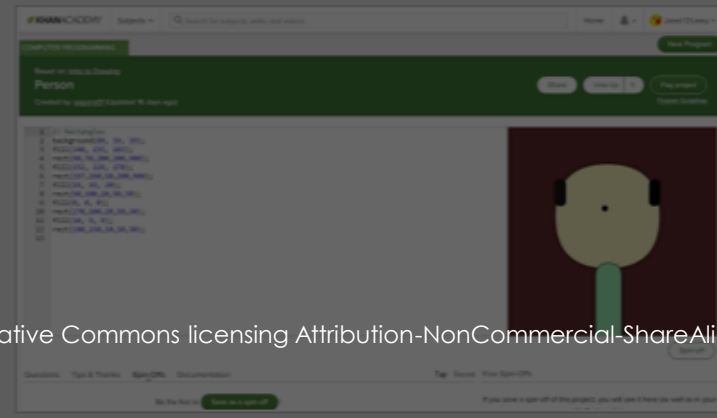
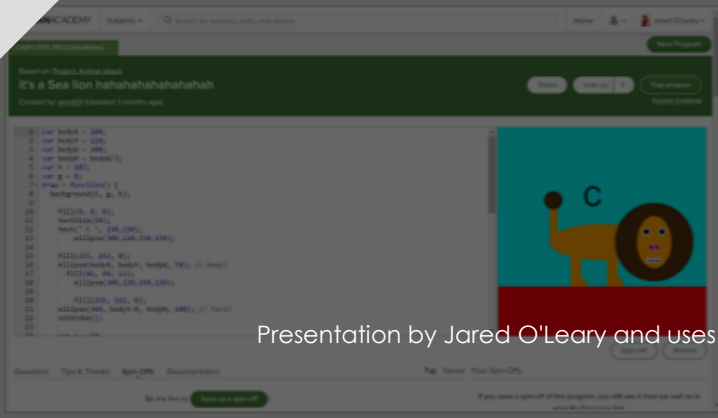
4



6

8

# Examples in Khan Academy



10

11

12

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# Explore Scratch projects

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1

https://scratch.mit.edu

2



Create

Explore

Tips

About

Search

Create stories, games, and animations  
Share with others around the world

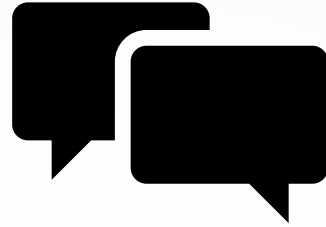


A creative learning community with **over 20 million** projects shared

[ABOUT SCRATCH](#) | [FOR EDUCATORS](#) | [FOR PARENTS](#)



Fixed



Flexible



Open



# Coder Resources

## An Amazing Maze Game

### Coder Resources

#### Example Project and Files

1. **Project:** [Example project](#)
2. **Video:** [Project Preview](#) (1:11)
3. **Video:** [Remixing a project](#) (1:57)
4. **Video:** [How to reverse engineer a project](#) (2:16)

#### Project Sequence

1. [Creating levels](#)
  - a. **Additional resources:**
    - i. **Video:** [Image editor: Bitmap mode](#) (3:38)
    - ii. **Video:** [Image editor: Vector mode](#) (4:31)
    - iii. **Video:** [Image editor: Extra tools](#) (4:12)
2. [Player controls](#)
3. [Restart function](#)
4. [Don't touch the walls](#)
5. [Gooooooooaaaaa!!!!!!!](#)
6. [Adding in comments](#)

#### Project Extensions

1. [Roguelike challenge](#)
2. [Adding variables \(Advanced\)](#)
3. [Cleaning up with functions](#)
4. [Sharing your project](#)  
[Creating a thumbnail](#)  
[Learn even more Scratch tips](#)

#### Debugging Exercises

1. [Why don't we switch to the next level when we touch the goal \(the green rectangle\)?](#)
2. [Why does Scratch Cat move to the right instead of the left when we press the left arrow?](#)
3. [Why do we stay on level 1 even when we reach the goal?](#)
4. [Even more debugging exercises](#)

# BootUp Curriculum

## Scratch (Grades 3+)

In this introductory sequence of projects for Scratch, we gradually introduce a variety of practices and concepts while simultaneously introducing a variety of blocks and tools in Scratch. Each of the projects is aligned with the algorithms and programming standards developed by the Core Knowledge Teachers Association (CSTA). Each project may take several classes to complete. Scratch (Grades 3+) Overview Video for projects #1-#10 (1:44), #11-#20 (1:48), and projects #21-#30 (1:44).

# Scratch Projects



### #1 Animate Your Name

**Minimum Experience:**  
Grades 3+, 1st year using Scratch, 1st quarter or



### #2 Interactive Collage

**Minimum Experience:**  
Grades 3+, 1st year using Scratch, 1st quarter or



### #3 Jump Scare Slideshow

**Minimum Experience:**  
Grades 3+, 1st year using Scratch, 1st quarter or

# Coder Resources

## Pumpkin Carver

**Minimum Experience:**  
Grades 3+, 1st year using Scratch, 3rd quarter or later

**Overview & Purpose:**  
Create a pumpkin carver simulator that allows users to "carve" a pumpkin with their mouse. The purpose of this project is to introduce a drawing application using pen blocks by combining them with previous understandings.

[LESSON PLAN](#) [CODER RESOURCES](#)



## Music Player

**Minimum Experience:**  
Grades 3+, 1st year using Scratch, 3rd quarter or later

**Overview & Purpose:**  
Combine previous understandings of event and control blocks to create a music player with multiple buttons. The purpose of this project is to reinforce understandings of modularity by combining previous understandings in a new context.

[LESSON PLAN](#) [CODER RESOURCES](#)

## #23 What Can You Create? Drawing

**Minimum Experience:**  
Grades 3+, 1st year using Scratch, 3rd quarter or later

**Overview & Purpose:**  
This challenge asks coders to use a limited selection of block types within an unlimited number of sprites to create art. The purpose of this challenge is to encourage coders to think creatively about block combinations to better understand algorithmic sequences.

[LESSON PLAN](#) [CODER RESOURCES](#)



## #26 Blinking Maze Game

**Minimum Experience:**  
Grades 3+, 1st year using Scratch, 3rd quarter or later

**Overview & Purpose:**  
Coders create a player controlled blinking maze game with multiple, custom levels. The purpose of this project is to reinforce understandings of the previous maze game, while introducing new mechanics.

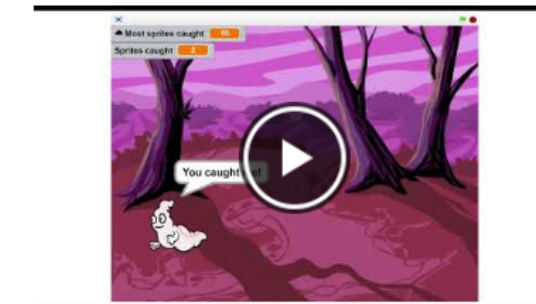
[LESSON PLAN](#) [CODER RESOURCES](#)

## #24 Carve a Pumpkin with Code

**Minimum Experience:**  
Grades 3+, 1st year using Scratch, 3rd quarter or later

**Overview & Purpose:**  
Coders continue to develop their understanding of pen blocks by creating algorithms to carve pumpkins. This purpose of this project is to reinforce understandings of how to draw shapes with code.

[LESSON PLAN](#) [CODER RESOURCES](#)



## #27 Sprite Catcher

**Minimum Experience:**  
Grades 3+, 1st year using Scratch, 3rd quarter or later

**Overview & Purpose:**  
Coders combine their understandings from previous projects to create a sprite catcher game. The purpose of this project is to reinforce understandings of modularity in a new context.

[LESSON PLAN](#) [CODER RESOURCES](#)

[goo.gl/MKn7Uz](https://goo.gl/MKn7Uz)  
(case sensitive)

Explore the “Coder Resources”





# Lesson Plans

## #22 Pumpkin Carver

### Minimum Experience:

Grades 3+, 1st year using Scratch, 3rd quarter or later

### Overview & Purpose:

Coders create a pumpkin carver simulator that allows users to "carve" a pumpkin with their mouse. The purpose of this project is to introduce creating a drawing application using pen blocks by combining them with previous understandings.

[LESSON PLAN](#)

[CODER RESOURCES](#)



## #25 Music Player

### Minimum Experience:

Grades 3+, 1st year using Scratch, 3rd quarter or later

### Overview & Purpose:

Coders combine their previous understandings of creating interactive buttons to create a music player with multiple buttons. The purpose of this project is to reinforce understandings of modularity by combining previous understandings within a new context.

[LESSON PLAN](#)

[CODER RESOURCES](#)

## #23 What Can You Create? Drawing

### Minimum Experience:

Grades 3+, 1st year using Scratch, 3rd quarter or later

### Overview & Purpose:

This challenge asks coders to use a limited selection of block types within an unlimited number of sprites to create art. The purpose of this challenge is to encourage coders to think creatively about block combinations to better understand algorithmic sequences.

[LESSON PLAN](#)

[CODER RESOURCES](#)



## #26 Blinking Maze Game

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### Overview & Purpose:

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[LESSON PLAN](#)

[CODER RESOURCES](#)

## #24 Carve a Pumpkin with Code

### Minimum Experience:

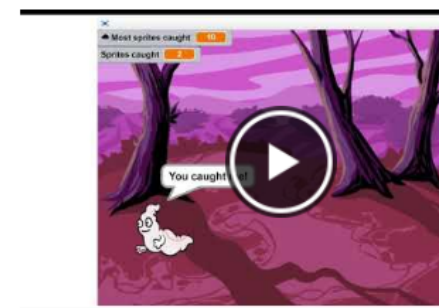
Grades 3+, 1st year using Scratch, 3rd quarter or later

### Overview & Purpose:

Coders continue to develop their understanding of pen blocks by creating algorithms to carve pumpkins. The purpose of this project is to reinforce understandings of how to draw with code.

[LESSON PLAN](#)

[CODER RESOURCES](#)



## #27 Sprite Catcher

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[LESSON PLAN](#)

[CODER RESOURCES](#)

17 An Amazing Maze Game ☆

1

View Insert Format Tools Add-ons Help Last edit was on May 29

Print layout  
Mode

2

✓ Show ruler  
✓ Show document outline Ctrl+Alt+A Ctrl+Alt+H  
Show equation toolbar  
Full screen

B I U A

1 2 3 4 5

Outline

An Amazing Maze

At a Glance

Overview and Purpose

Objectives and Standards

Practices and Concepts

Scratch Blocks

Vocabulary

Connections

Resources

Project Sequence

Preparation (20+ minutes)

3



# An Amazing Maze Game

Minimum experience: Grades 3+, 1st year using Scratch, 2nd quarter

## At a Glance

## Overview and Purpose

Coders create a player controlled maze game with multiple, custom levels. The purpose of this project is to use conditional statements ([if blocks](#)) to create player controls, while reinforcing how to use the if

## Objectives and Standards

### Process objective(s):

#### Statement:

- I will learn how to create player controls in Scratch.
- I will learn how to create custom backdrops in Scratch.

#### Question:

### Product objective(s):

#### Statement:

- I will create a player controlled maze game with multiple levels.

#### Question:

- How can we create a player controlled maze game with multiple levels?

# BootUp Curriculum

## ScratchJr (Grades K-2)

In this introductory sequence of projects for ScratchJr, we gradually introduce a variety of practices and concepts while simultaneously introducing coders to a variety of blocks and tools in ScratchJr. Each of the projects is aligned with the algorithms and programming standards developed by the Computer Science Teachers Association (CSTA). Each project may take several classes to complete. ScratchJr (Grades K-2) Overview Video #1-#10 (1:18), projects #11-#20 (1:32), and projects #21-#30 (1:35).

# ScratchJr



### #1 Dancing Alone

**Minimum Experience:**

Grades K+, 1st year using Scratch Jr., 1st quarter or



### #2 Can't Stop Dancing

**Minimum Experience:**

Grades K+, 1st year using Scratch Jr., 1st quarter or



### #3 Dance Party

**Minimum Experience:**

Grades K+, 1st year using Scratch Jr., 1st

Upcoming  
sessions I'm  
presenting

➤ **Tuesday, July 10<sup>th</sup>**

➤ **Assessing Coding Projects**

➤ *10:00-10:20 am in room 213*

➤ **Moving Beyond Puzzles:  
Project-based Coding**

➤ *10:40-11:00 am in room 212*

# Q&A

- [www.JaredOLEary.com](http://www.JaredOLEary.com)
  - Presentations
  - Project-based Learning with Scratch

